A STUDY OF THE UNDERSTANDING OF SCIENCE AND SCIENTIFIC TEMPER OF HINDU AND MUSLIM STUDENTS

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CERTIFICATE

Certified that the Thesis entitled *"A STUDY OF THE UNDERSTANDING OF SCIENCE AND SCIENTIFIC TEMPER OF HINDU AND MUSLIM STUDENTS"*, submitted by Shri Ramendra Kumar Gupta, Lecturer, Deptt. of Teacher-Education D. V. (Post Graduate) College, Orai for the award of Ph. D. Degree in Education of the Bundelkhand University Jhansi, is the candidate's own work, which has been carried out under my guidence and supervision for the required period as per the ordinance of Bundelkhand University, Jhansi.

(Dr. Ram Lakhan Vishwakarma)

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Developing countries initiated science education programmes during 1960s to keep pace with the growing culture of science. India started formal and non-formal programmes to develop an understanding as well as an appreciation of science among school children. A major shift towards development of indigenous science curriculum and science teacher education programmes were essential to satisfy socio-academic needs. How far such programmes have achieved the expected goals is a question to be answered ? This humble research is an attempt in this direction.

The investigator had an apportunity to visit Singapore in June, 1996 and 2001, where he visualised the importance of understanding of science. This small but developed nation has re-emphasized on the development of Public understanding of Science, which was supported by the Royal Society Report (1985), The Public Understanding of Science. This Thesis is a result of such experience and impetus.

I have been indebted to a number of persons in the cource of this research work, It would have been impossible for me to work without their co-operation and encouragements. As such it is my duty to acknowledge their co-operation earnestly and to express my sense of gratitude to them.

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Orai
The World Environment Day
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(Ramendra Kumar Gupta)

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CHAPTER I

THE PROBLEM AND ITS SIGNFICANCE

1.1 Introduction

Science and Technology have been an integral part of the Indian tradition since time immemorial, dating back saveral milenia. In fact, for as long as 4000 to 5000 years preceding the 'industrial revolution'. India was always in the forefront as far as contemporary scientific knowledge and its understanding were concerned. It was however, only after independence and through the vision and wholehearted support of India's first Prime Minister Pt. Jawahar Lal Nehru, that S & T were developed in a conscious way as a major force for social and economic change. Even constitution of India, Chapeter IV A, Fundamental Duties of Citizens, the Article 51 A (h) clearly states that "It shall be the duty of every citizen of India-to develop scientific temper, humanism and the spirit of inquiry and reform." It seeks that science must permeate the whole of our national life and all areas of endeavour. The development of S & T as a means to meet vital national needs is now accepted a major planning objective as is evident from the Science & Technology Policy 2003 especially Chap. 12 of the S & T Policy 2003 : Public Awareness of Science and Technology.

The ever increasing role of science & technology raised questions about their proper use. This new phase has necessitated the development of scientifically literate citizenry which can take objective decisions concerning socio-scientific issues, perhaps, the most significant need for all citizens is understanding of science and technology and its ethos .

In this context the UNESCO Bulletin (1983) has stated that there is a need of Scinece For All (SFA) which highlights the recognition of science & technology as being of value for everyone. It also states the need to democratize science, to make science available for all religion, culture and society.

The Royal Society (1985) has very justly elaborated that, "Everyone needs some understanding of science, its accomplishments and its limitations whether or not they are themselves scientists or engineers. Improving that understanding is not a luxury, it is a vital investment in the future well being of the society. In this elaboration there is an urgent need that the general fabric of society will have to be rewoven with the weft strengthened by scientific outlook. In traditional societies like ours understanding of science and acquisition of scientific temper are a part of basic assentials which will sustain democracy and provide desired wisdom to use science and technology properly.

Religion and Adolescent's Personality Development :

Adoloscent's personality development is seen to be an outcome of his socialization which begins in his home. The home passes to him

family attitudes, values, prejudices, styles of living, traditions, beliefs and life prectices. The home, through the experiences it offers to him teaches him about the world real or unreal, it is the total environmer t of the home that influences his development. Religion of the home, may be presumed to effect adolescents personality development. Religion is a way of life entailing specific values, beliefs and practices. The religion practised in the home must imprint in the mind of the adolescent these values and beliefs giving a definite shape to the pensonality of the adolescent. Adolescents, thus, brought up in the homes of different religions must show differential personality patterns, understanding of science & scientific temper being parts of personality too, must be differentially patterned by different religions practised in the homes of the adolescents. Currently, there is no research evidence of any kind available in this regard. Hence, this reseacher proposed to conduct an empirical research to obtain evidence as to how the religion (here Hindu and Muslim only) of the students linked with the understanding of science & scientific temper. The religion practised in the home may affect the development of pensonality qualities, attitudes and behaviour patterns of the parents of the adolescents. These, in turn, must influence the personality development of the adolescents also, as he identifies with them and tries to imitate ways of their living. Parents are the first socializing agent of the adolescent. Mooris and Nicholas have noted similarities between personality disturbances of parents and children demonstrating that personality characteristics of parents are,

unknowingly, adopted by their children. Conformity to parental religious beliefs, ideas and thinking may bring to the adolescent greater acceptatility in the home. Hence, unwittingly, he models himself like his parents and thus, inherits their personality characteristics. Since religion wise large variations are found over Hindu & Muslim homes, the adolescents brought-up in these homes must also develop differential personality patterns including differences in their understanding of Science & Scientific temper. It is enough resonable to believe that the Hindu adolescent with regard to his personality development level of understanding of science & scientific temper may not be same as the Muslim adolescent. There may be uniqueness linked with personality of each of them. If this is found, that may be attributed to the differences in religions of their homes. Such studies are not found in the field. Hence, the researcher decided to conduct this study.

1.2 Statement of the Problem

The investigator has researched the following problem : *"A STUDY OF THE UNDERSTANDIG OF SCIENCE AND SCIENTIFIC TEMPER OF HINDU AND MUSLIM STUDENTS"*

1.3 Objectives of the Study

The study was planned to achieve the following objectives :

1. To determine the levels of understanding of science among Hindu and Muslim students.
2. To study the effect of type of school, class level, geographical locale and sex on levels of understanding of science.

3. To study the levels of scientific temper among the Hindu and Muslim students.
4. To study the effect of type of school, class level, geographical locale and sex on levels of scientific temper.
5. To determine the relationship between levels of scientific temper and understanding of science.

1.4 Hypotheses of the Study

In order to achieve the foregoing objectives, following hypotheses were formulated ;

1. Theoretical mean of the total sample is not different than the obtained mean on the understanding of science scale.
2. Students from Hindu & Muslim religion are not different on the understanding of science scale and on its dimesions.
3. Students of different groups are not different on scores of understanding of science scale and its dimensions due to class level differences.
4. Students of different classes are not different on the scores of the understanding of science scale and its dimensions.
5. Students from urban and rural schools are not different on the scores of the understanding of science scale and its dimensions.
6. Students from different types of school are not different on the scores of the understanding of science scale and its dimensions.
7. Theoretical mean of the total sample is not different than the obtained mean on the scientific temper scale.

8. Students from Hindu and Muslim religion are not different on the scientific temper scale and on its dimensions.
9. Students of different groups are not different on scores of scientific temper and its dimensions due to class level differences.
10. Students of different sexes are not different on the scores of scientific temper and its dimensions.
11. Students from urban & rural schools are not different on the scores of scientific temper scale and its dimensions.
12. Students from different types of schools are not different on the scores of the scientific temper scale and its dimensions.
13. These is no significant relationship between scores of scientific temper scale.
14. There is no significant effect of following on coefficient of correlation between scores of understanding of science and scientific temper :

i) Class level of students

ii) Geographical location of students

iii) Type of school of students

iv) Sex of students

1.5 Conceptual Framework

Since independence, India has been committed to the task of promoting the spread of science and technology. Dissemination of

scientific attitude among the massess is necessary for the nation's progress. Science communication activities through different mass media-print, broadcast, folk, interactive or digital-focus on the interpretation of scientific knowledge to the public, and they play an important role in developing a scientifically informed and attitudinally rational society. Sustained efforts in science communication that would enhance the public understanding of science are, therefore, important.

India's Science Policy

On 4th march 1958 the Government of India adopted the Scientific Policy resolution that pronounces : "It is only through the scientific approach and method, and the use of scientific knowledge that resonable material and cultural amenities and services can be provided for every member of the community." Some of the objectives of India's Science Policy are as follows :

i) to provide the people of India the benefits from the acquisition of scientific knowledge and its applications.

ii) to foster science & scientific research in all its aspects, namely, basic, applied and educational.

iii) to encourage individual initiatives for acquisition and dissemination of knowledge and for discovery of new knowledge, and

iv) to train scientific & technical personal to tulfill the needs in various fields like agriculture, industry, defence etc,

For advancing scientific temper in society in the new era of

globalization, the Government of India enunciated a new Science & Technology Policy in January 2003. The focus of this policy is :

> To ensure that the message of science reaches every citizen of India, so that we advance scientific temper and understanding of science, emerge as a progressive and enlightened society, and make it possible for all our people to participate fully in the development of science and technology and its application for human welfare. Indeed science and technology will be fully integrated with all spheres of national activity.

In the Science & Technology Policy, 2003 due recognition has been given to the enhancement of public awareness of science & technology. It emphasizes :

> People must be able to consider the implications of emerging science and technology options in areas which impinge directly upon their lives, including the ethical and moral, legal, social and economic aspects. In recent years, advances in biotechnology and inforation technology (IT) have dramatically increased public interest in technology options in wide ranging areas. Scientific work and policies arising from these have to be highly transparent and widely understood. Support for wide dissemination of scientific knowledge, through the support of science museums, planetaria, botanical gardens and the like, will be enhanced. Every effort will be made to convey to the young the excitement in scientific and technological advances and to instill scientific temper in the population at large. Special support will be provided for programmes that seek to popularize and promote science and technology in all parts of the country. Programmes will also be developed to promote learning and dissemination of science through various national languages, to enable effective science communication at all levels.

Science Popularisation :

To generate public awareness on some particular issues of S & T, for quite sometime now, we have been observing a number of dates with usual enthusiasm and gaity (Appendix C : Science Writers' Calender). This day syndrome is primarily characterised by multi-media publicity

on a suitable theme, the message(s) and organisation of seminars, symposia, exhibitions, popular lectures and get togethers with brain storming sessions. The events are specially popular in educational institutions. The general public too gets an excellent oppotunity through open houses to peep inside our Research and Development (R & D) organisations.

With this backdrop, it is heartening to note that the popularisation of indigenous science is percolating fast at the grassroot level. More so, from the year 1987 onwards, the movement is goining momentum, witnessing three major events, viz, the first National science Day (28 February), the Nationwide S & T communication event, the Bharat Jan Vigyan Jatha (BJVJ)-2nd October to 7th November and the national awards for science popularisation. Added to this, May 11 is being celebrated as the National Technology Day since 1999. The *Year 2004* was celebrated as the *Year of Scientific Awareness* (YSA) in our country.

Year of Scientific Awareness Objectives :

* Make as many people scientific aware as possible.
* Make more & more people habitual of keeping themselves scientifically aware by acquiring the required knowledge and informations and satisfactory answers & questions that arise in their minds.
* Help create an atmosphere and conditions conducive to more and more people readily and essily becoming scientifically aware.

* Encourage more & more people to make practical use of their scientific awareness in day to day life, in arriving at decisions concerning issues/subjects of concern to them, in overcoming superstitions and tackling blind beliefs and in handling situations arising out of age-old practices and traditions which actually hinder progress, harmony, or even may harm others.

Year of Scientific Awareness Activities :

* Discussion sessions, public debates on burning and controversial issues.
* Theme-based exhibitions.
* Radio & television programmes, multi-media CDs publications, posters and wall-charts
* Awareness compaigns on specific issues/themes
* Puppet shows and folk-performances, popular lectures
* Contests and competitions
* Features & articles in newspapers and
* Activity and experiment corners for children.

Apart from the above activities for promoting scientific awareness, understanding & temper, there are awards & prizes (Appendix D : Award & Prizes) also which are promoting an individual for dissemination and popularisation of science. Added to the four national awards by Union Ministry of Science and Technology, the biennial Indira Gandhi Prize for Popularisation of science instituted in 1986, by the New Delhi based Indian National Science Academy is equally

prestigious. Beginning from 1994-95, the Kolkata-based Indian Science Congress Association has instituted Dr. B. C. Deb Memorial Award for popularisation of Science. In addition to this, there is the Kalinga Prize. Established by UNESCO in 1951, the Kalinga Prize is an annual international award of Pound 2000, based on a grant to UNESCO from Shri B. Patnaik, Founder & Chairman of the Kalinga Foundation Trust and a UNESCO Albert Einstein Silver Medal. Four Indians have been awarded the Kalinga Prize for the Pobularisation of Science. Dr. Jagjit Singh was the first Indian to get this prize in 1963, In 1991, Dr. Narendra K. Sehgal shared it with Romania's Dr. Radu Iftimovici. In 1996, Dr. J. V. Narlikar shared it with Dr. J. Grygar of Czech Republic and in 1997 Dr. D. Balasubramanian was awarded this coveted prize.[1]

To popularise S & T among people at the grass-root level in country like ours is indeed an arduous task. With 2.4 percent of the world land area, India is presently suppoting 16.7 percent of the world population. One in every seven persons on this planet lives in India. In absolute number, the population of the country was 1028 million on 1st March 2001 with a literacy rate of 64.84 percent (males : 75.26%, females : 53.67%) in 1991 (India 2005) and so many languages & dialects, all possible channels of communication (inter- personal channels- home visits, group meetings, traditional folk media - drama, puppet show, kirtan/ bhajan/qwali, yatra, nautanki, tamasha and mass media - radio/

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1. http : //www.unesco.org/science/ips/science/prizes/kalinga winners.htm as accessed on June 27, 2005.

transistor, television, film, exhibition, poster, wall painting/hourding, pamphlet/leaflet, newspaper, magazine, telephone) are being employed extensively and effectively.

Insofar as the coverage of S & T is concerned, the scenario is fast changing Look at the electronic media, various success stories included 144-part weekly-radio serial on "Human Evolution" broadcast nationwide from 84 All India Radio (AIR), AIR stations in 18 languages Radio-DATE (Drug Alcohol Tobaco Education), broadcast from 84 radio stations in 30 episodes in 16 languages during April 8 to 28 October, 1990 and so on. Even the veriety of popular science programme broadcast in English & major Indian languages from various science cells of AIR stations have shown qualitative and quantitative improvement over the years. TV channels like *National Geographic, Discovery* and *Animal Planet* are, however, contributing well for science and technology popularisation. Programmes like *Turning Point, Kudratnama* and *Bharart Ki Chaap* were also liked by the Indian masses. UGC/IGNOU TV telecasts do covers several scientific & technological topics but their level of comprehension is generally above that of the ordinary viewers.

TV serials, on the contrary, are providing the general masses with a concentrated dose of mythology/religion and unscientific ideas. With programmes like *Aap Ke sitare, Aap Ka Bhavishya, Aaj Ka Din* being telecast concurrently on several TV channels, the cultivation of scientific temper gets a nosedive. Whereas in the west a good number of films/ movies are produced which are based on some scientific concepts but

such films are a rarity in Hindi filmdom. The establishment of science cities in Kolkata (West Bengal) and Jalandhar (Punjab) has fulfilled a long pending demand of the scientific community and is a welcome sign. It is the establishment of a science and technological museum/ planetarium/aquarium/zoo/botanical garden/sanctuary/forest reserve in each state of India that can help in raising the level of scientific awareness of students in particular and the lay people in general.

Publications : Print Media in Popularisation of Science :

Besides the occasional write ups on weekends in the magazine sections of various newspapers, English daily *The Hindu* (Thursday) continues to bring out an exclusive weekly science page/section/ supplement-an uncommon fare in our Hindi and regional language newspapers. Annual issues of *The Hindu* on Survey of Indian Agriculture, Survey of the Environment and Survey of Indian Industry provide excellent data on productivity, financial outlays, trends and problems in the respective sector.

The popular science wing to the Union Ministry of Science & Technology, the National Council for Science & Technology Communication (NCSTC) and its autonomous outfit, Vigyan Prasar are the major players of science popularisation in our country. The bilingual (English & Hindi) monthly gratis newsletter, *NCSTC Communications/ RVPSP Sandesh* provides the latest and the most recent information in the country on science popularisation. The recently launched periodical

Indian Journal of Science Communication as also the fortnightly bilingual (Hindi & English) wall newspaper on S & T *Kyon Aur Kaise* are certainly picking up.

The New Delhi based National Institue of Science Communication and Information Rosources (NISCAIR) of the council of Scientific & industrial Research (CSIR) has get the distinction of bringing out three widely circulated top-class popular science magazines of our country: The Hindi monthly *Vigyan Pragati* (started in 1952), English monthly *Science Reporter* (started in 1975), Under the science popularisation programme of the NISCAIR, a series of scientific books have been published. These books have been very well received by the students and general public. The scientific encyclopedia *Golden Treasury of S & T* is indeed a goldmine of authentic information. This encyclopedia focuses on Indian contributions as well, which generally receive scant attention in the usual lasting value publications of this type.

In fact it is the print media which offers many options to keep abreast of the latest developments in different field of S & T. Although plenty of extraordinarily expensive Western print stuff is readily available, there is no dearth of indegenous, extremely inexpensive and above all authentic material in our country. Our indigenous stuff has the essential characteristics of *SPEED*-simple, practical, economical, effective and duplicable. For example in the health sector, New Delhi-based Central Health Education Bureau (CHEB), brings out two monthly magazines, *Swasth Hind* in English and *Arogaya Sandesh* in Hindi. The health

education folders of the CHEB describing briefly the important symptoms and preventive measuses of a number of diseases are equally popular. Similarly the popular illustrated quarterly periodicals on food, nutrition and health, *Nutrition* in English, *Poshan* in Hindi and *Poshana* in Telugu of the Hyderabad-based National Institute of Nutrition of Indian council of Medical Research (ICMR) are quite popular. In fact quite a few layman friendly titles are available with the National Book Trust (NBT), the CHEB, *Vigyan Prasar* (Known for bringing out an excellent periodical, *Dream* 2047) and ICMR. At the non-gevernmental level, the Voluntary Health Association of India, New Delhi is one of the major player in health education besides 'n' number of NGOs and some commercial ventures.

In the field of environment education or sustainable development, the science & environment fortnightly *Down To Earth* undoubtedly tops the tally Brought out regularly by the New-Delhi based society for Environmental Communications, each issue of this magazine is packed with authentic information. The Ahmedabad-based Centre for Environment Education brings out quite a few lasting value titles in English, Hindi and Gujarati through its EDUTECH channel. Same is true for World Wide Fund (WWF) for Nature- India. In the area of environmental education, the Ministry of Environment and Forests, Government of India supports two centres of excellence. These are the Centre for Environment Education Chennai and the Centre for Environment Education, Ahmedabad, are involved in developing innovative programmes and materials to increase awareness about the

environment. The National Museum of Natural History, New Delhi is a unique facility which provides people an opportunity to aquire a direct understanding of the nature. Regional Museums of Natural History are located at Mysore, Bhubaneshwar and Bhopal.

Even the Council for Advancement of People's Action & Rural Technology (CAPART) is playing a significant role in this endeavour. In the field of agriculture. Indian council for Agricultural Research (ICAR), brings out popular journals in the field of agaricultur, animal husbandry and allied subjects. ICAR publishes farmer-friendly monthly journal and layman-friendly quarterly periodicals in Hindi and English. ICAR also brings out a number of books on agriculture and allied subjects. Popular Science & Technology (PST) series of the Delhi-based defence Scientific Information & Documentation Centre aims at promoting the understanding of the applications of S & T to defence situations. Each issue of PST is devoted to a particular topic & current interest and is written by specialist in the field.

Other Efforts for Popularisation of Science :

Some other notable agencies engaged in S & T popularisation include National Research Development Corporation known for its popular science magaziness *Invention, Intelligence* and *Aawishkar,* Kolkata-based Indian Science Congress Association (ISCA) brings out a popular science bi-monthly *Every Man's Science* and Vigyan Parishad, Allahabad crown for first Hindi Science magazine in India. *Vigyan* published since 1915.

For popularising science & technology among general public and in particular, students, the *National Council of Science Musaums (NCSM) established* on April 4, 1978, has completed over 28 years. It has 28 Science Centres spread all over India, (Appendix E : 25 Years of NCSM-Important Achievements at a Glance), which attract directly about 55 lakh visitors annually besides about 25 lakh people residing in rural areas, receive the messages of science annually through a fleet of 22 Mobile Science Exhibition units of the Council. In another significant addition to science museums, the *National Agricultural Science Musaums* of the ICAR was inaugrated by Honourable President of India Dr. A. P. J. Abdul Kalam, first of its kind in the country, is situated in the National Agricultural Science Centre Complex, Pusa, New Delhi.

The Development and Educational Communication Unit of the Indian Space Research Organisation (ISRO), Ahmedabad is yet another outstanding outfit for science popularisation. In a significant move, the University Grants Commission (UGC) has set up an Inter-University Consortium for Educational Communication to coordinate, streamline and strengthen the activities of various departments of communication in the universities, the Education Media Research Centres (EMRCs) and the Audio Visual Research Centres (AVRCs).

At the NGO level, the Indian Sciences Writers' Association (ISWA) and 'n' number of other agencies such as States S & T councils are playing a significant role in this endeavour. Some important websites for science writers are given in Appendix F.

However, the need of the hour is to popularise these inexpensive indigenous initiatives amongst masses as ignorance and lack of correct information put people at a greater risk.

Since formal education is the main source of developing an understanding of science and inculcating scientific temper, we need proper and continuous feedback to determine the levels of the understanding of science or to find out their levels of scientific temper. Our main goal is that scientific thinking, scientific temper and understanding of science is a way of living, a mode to think critically and act rationally. How far our students reach these expectations and how different variables of education, geographical and religious differences influence the modes of living and action, has to be determined?

1.6 Significance of the Study

The key of the national prosperity, apart from the spirit of the people lies, in the modern age, in the effective combination of three factors, technology, raw materials and capital, of which the first is perhaps the most important, since the creation and adoption of new scienctific techniques can, in fact, make up for a deficiency in natural resources, and reduce the demands on capital. But technology can only grow out of the study of science and its implications.

The dominating feature of the contemporary world is the intense cultivation of science on a large scale, and its application to meet a country's requirements. It is this which for the first time in man's history, has given to the common man in countries advanced in science, a standard of living and social and cultural amenities, which were once confined to a very small privileged minority of the population. Science has led to the growth and diffusion of culture to an extent never possible before. It has not only radically altered man's material environment, but, what is of deeper significance. It has peovided

> new tools of thought and has extended man's mental horizon. It has thus influenced even the basic values of life, and given to civilisation a new viality and a new dynamism.
> It is only through the scienctific approach & method and the use of scientific knowledge that resonable material and cultural amenites and services can be provided for every member of the community.
> The wealth and prosperity of a nation depend on the effective utilisation of its human and material resources through industrialisation. The use of human material for industrialisation demands its education in science and training in technical skills Industry opens up possibilities of greater fulfilment for the individual. India's enormous resources of manpower can only become an asset in the modern world when trained and educated.

The above Scientific Policy Resolution was placed before both the Houses of Parliament on March 13, 1958 by Pt. Jawaharlal Nehru, our first Prime Minister.

All these resolution have lead to Science for All. Science for All has become a slogan of 1980. A common theme of many recent reports and recommendations, including Alternative for Science Education (1979) and Education in Science (1981). The Public Understanding of Science, a Royal Society Publication (1985) has observed : "A basic thesis is that better understanding of science can be a major element in promoting national prosperity, in raising the quality of public and private decision making and in inriching the life of the individual."

Similarly, Hodson and Reid (1988) have observed :

> There is no doubt that the continued wealth and prosperity of the country depends, in part, on the supply of well-qualified and imaginative scientists, technologists and engineers. But material prosperity is not the only motive for advocating universal science education, nor it is the most important. A

> society that educates only a minority of its citizens in science & technology is a potentially unjust society, because in locating increasingly powerful knowlege in the hands of a few it locates power and decision making in the hands of a few. Thus science for all is a necessary part of ensuring and maintaining a socially just democratic society.

Seeing the importance of science, it has been taken as one of the main components of core curriculum at elementary and secondary school stages. Secondly, study of science has been related to economic development. These decisions hopefully lead to preparing a scientifically literate society. Such people will subscribe to scientific thinking and scientific temper.

Development of Understanding of Science has been pleaded by the Royal Society (1985) on the following considerations :

i) Better public understanding of science can be major element in promoting national prosperity.

ii) In raising the quality of public and private decision making.

iii) In enriching the life of the individual, and

iv) Proper utilisation of natural resources.

The more general case has been summarised by Thomas and Durant (1987). Reviewing an extensive and diverse literature, they identified arguments for the promotion of the Public Understanding of Science. There arguments are distinguished by reference to the benefits associated with them, namely :

* benefits to science itself,

* benefits to national prosperity,

* benefits to democratic government,
* benefits to society as a whole,
* benefits to intellectual life,
* benefits to aesthetic appreciation, and
* benefits to morality.

The Second aspect, Scientific Temper is equally important and has much more relevance in the contemporary society. Scientific temper is a value based perception which reflects objectivity, rationality, reflective scrutiny of what we do when the decision making process is involved. Scientific temper begins from each individual, that permeates to all, intellectual creativity and generating social ethos to make this world a place which is worth living.

A survey of the related research in India and abroad has indicated that there were few studies on Understanding of Science and Scientific Temper, specially with regards to religion, namely Hindu and Muslim.

Since, there is ample scope to probe further, the investigator has taken this aspect. Such an socially relevant educational issue needs constant feedback based on empirical evidences to provide valuable pointers to bring a desired change in school science education.

These observations provide sufficient substance and justify the investigation undertaken.

1.7 Sample

The investigator has selected sample of Hindu and Muslim students of Government and Private Secondary Schools of Jhansi region, comprising three Districts : Jhansi, Orai (Jalaun) and Lalitpur, as follows:

Total sample N = 1000

9th class students

Hindu N = 400 Muslim N = 260

Total 9th calss students N = 660

10th calss students

Hindu N = 200 Muslim N = 140

Total 10th calss students N = 340

1.8 Definition of Terms

Understanding of Science :

Science is a composite concept which includes from Botany and Zoology to environment related socio-scientific issues. It also includes concepts from different disciplines of science, scientific thinking and values of science. Understanding for this study includes comprehension of concepts of science, nature of scientific activity and inquiry.

Understanding of science has been taken as comprehension of some scientific content, concern for ethical issues related to science, faith in scientific values and responsibility in decision making concerning socio-scientific issues.

Scientific Temper :

The world 'Scientific' was firtst used in 1840 by, W. Whewell. Science is 'reasoned knowledge' about facts, things, persons, natural phenomena and social behaviour. 'Temper' is a particular state or habit of mind especially with respect to disposition. Therefore, scientific temper represents a spirit of inquiry based on logical reasoning. The ability to think objectively, logically and analytically leads to the development of scientific tempr. It is by nurturing scientific temper that one can be liberated from dogmatism, irrational beliefs and superstition.

In this study the investigator has defined scientific temper as follows :

Scientific temper is a unified state of mind, comprising thoughts, action and conduct of an individual in a specific situation. Scientific temper is a process of thinking to act objectively, rationally based on available evidences at the time of making decisions.

Different Geographical Locales :

In this study data has been collected from urban and rural areas where different type of schools are functioning. Therefore, different geographical locales reflects the location of a school and the area which feeds students to the schools.

1.9 Delimitations of the Study

In this study the investingator has taken a sample of 1000, comprising 660, 9th class students and 340, 10th class students, from

Government and Private Secondary Schools, from Jhansi region of U. P.

Further, the sample has been restricted to unban and rural schools of Jhansi region. Only two aspects of science education will be studied, namely Understanding of Science and Scientific Temper, keeping in view that these two aspects are the basic elements of science education.

The study will be further delimited to the students of two religion, namely Hindu & Muslim.

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CHAPTER II

REVIEW OF THE RELATED STUDIES

2.1 Introduction

A researcher tries to understand the field of study by screening related studies attempted by the predecessors. Such an attempt gives required cues to understand different dimensions of the study. Specifically, there are two important advantages of review. First, it helps in avoiding duplication of work. Many a times duplication is desirable provided it gives new insight or provides new direction or shows new paths of undertaking research. Second, a thorough review of the related studies gives general awareness about the field of sudy, insight into the intricacies of the field and new vision to get ideas to undertake such studies.

In this study, the researcher has selected two areas of science education. First area is understanding of science and the second area is scientific temper. The investigator has a feeling that the understanding of science spontaneously develops attitudes, values of science, and scientific temper.

The scope of this review and synthesis is limited only to those studies which have direct bearing on the present investigation. It appears

that limited attempts have been made in this area of research. This field has been enriched by recent research, though, much has been said and done about this field of work earlier.

This area of research is of great value to India. The country has realized that science education is an integral part of school education and science and technology education should be broad based and accessible to all students at all stages of primary and secondary education. It is also valuable to adult population. In other words, the country needs, scientifically literate citizenry to understand science, to participate in socio-scientific issues and to acquire values of science to make objective decisions. The study of science should foster inquiring, questioning and critical attitudes which are a part of scientific temper.

Considerable international interest has been shown by educationists, scientists and politicians to develop scientifically literate citizenry so that people can understand science and its related technology. There is an urgent need to understand problems such as, environmental degradation, pollution, population growth, energy crisis, radioactive fall out, harmful effects of insecticides and industrial disasters. Therefore, it is imperative that science and technology has a social perspective. *Silent Spring* was published in 1962. This book directed the world's attention to the detrimental effect of chemicals. Rachel Carson warned that the indiscriminate use of chemicals could 'linger in the soil', 'slow the leaping fish' and 'still the song of birds'. If society continued contaminating environment, then one day society would experience a

silent spring. Similarly, James lovelok, in his book *Gaia* (1978) has argued to maintain an ideal relationship between man and his environment. He has cautioned to protect tropical forests, particularly in Brazil. Prof. Carl Sagon has cautioned about the production of CFC, Chloro-Fluoro Carbon gas which is used as working fluid in refrigeration and air conditioning and its release destroys ozone in atmosphere. In his Nehru Memorial Lecture, in 1991 Prof. Sagon has argued that the destruction of ozone layer is a cause of skin cancer, eye cataract and many diseases. There has been many incidents of oil spill in sea which damaged not only ecology but the life in sea. Therefore, there is need of understanding science to become an active participant in solving socio-scientific issues.

The problem has an educational perspective. There is a need to relate science to its social and technological context. It will help in presenting that science manifests in all aspects of the world, and that it has a human face. Science and technology interact with, influence, and change society and this interaction can have important consequences. Therefore, science for all has been accepted by most of the countries as a part of core curriculum.

2.2 Studies Related to Understanding of Science

The Royal Society's report has mentioned that limited work has been done in this area and detailed investigations into the scientific knowledge which adults possess are sparse.

One of the most extensive publications in this area has been carried out by the National Assessment of Educational Progress (NAEP) in the United States where national samples of approximately 2000 adults in 1972-73 and 1300 in 1976-77 were stratified according to geographical region, community size, community type (urban/rural) and socio-economic status (NAEP, 1979). Adults survey were within the age range of 26-36 representing those years when formal education had ceased and careers were being developed.

Holmes and Wright (1980) in their report on the NAEP Survey results point out that persons in this age were often socially active and concerned about science and society issues. The national survey has indicated that percentage of answers/answer correctly was 44.6 percent in 1972-73 and 40.7 percent in 1976-77. This was taken an evidence of a decline in the science performance of young adults.

In a conceptual and empirical review of scientific literacy, Miller (1983) described the NAEP survey and argued a case for the secondary analysis of the data archive to produce a better portrait of the scientific understanding of young adults.

A new trend to explore the understanding of selected technical terms was like radiation, computer software, and how telephone works etc. were attempted. National Science Board's report, Science Indicators, 1985 has summarised such findings as follows :

TABLE 2.1

PUBLIC UNDERSTANDING OF SELECTED TECHNICAL TERMS
(N=1972)

	Clear	General	Little
Radiation	31%	57%	19%
Computer Software	24%	33%	43%
How a telephone works ?	19%	48%	33%

A study on Public knowledge of Elementary Physics was carried on by A. M. Lucas (1988). The study shows how to ensure that the knowledge of science acquired by children at the school level is retained in adulthood and whether it is useful to them.

This assumption has relationship with the public understanding of science which is being discussed in UK at present. This study has been conducted to assess the level of scientific knowledge among the British Public. In this study the sample was 1033 British people aged 15 years above, interviewed face to face from 21st June to 1st July, 1986.

This study was attemped to obtain data about the knowledge of simple scientific ideas held by the members of general public.

It included questions multiple choice, true false, free response etc. The level of these questions were of grade IV CSE candidates.

In addition to the knowledge questions, researcher also asked about the respondent's highest level of formal education in science and

non - science subjects. The investigator discussed the relationship between level of education received with the answer given to the questions. The finding were as follows :

Sex Effects

The data has shown that women as a group are less successful in answering the questions appropriately. Men scored 11.4 correct answer over all 24 questions and women 10.0. It was also revealed that in all cases there were more women who claim that they do not know.

Educatinal Background

There seems to be little reference between these questions and their use in everyday life and for this reason they did not bother, People use products of science unthinkingly and it is extremely difficult to find evidence that knowledge of elementary science has utilitarian value in our everyday life.

This study has revealed that how little of the science that we spend so much time at school attempting to get children to remember is indeed rememberence to adulthood. This leads to the use of process approach to science teaching.

The calssroom discussion of social issues by Joan Solomon and Kate Harrison in *Education in Science* 1990 has discussed some of the topics on kidney transplant, industrial waste, nuclear power.

The Discussion of Issues in school science is a project as a link research programme on the Public Understanding of Science. This project is concerned with school age participants.

Public view are important to judge their opinion about the risk of some scientific activities. It is also related to value or moral judgements.

What pupils feel about these issues is the crux of the whole matter. Personal and Social education cannot fail to be influenced by different styles of learning, such as small group discussions, to encourage schools to recognise that a democratic society thrives only where there is active debate about, and concern for values, and that education is crucial in ensuring that this can occur in a constructive spirit and manner.

Lucas (1987) in another study on 'The Public Understanding of Biology' has reported that the sample (N=1033) has had gaps in their knowledge concerning biology.

Beverley Bell (1984) conducted study on 'Aspects of secondary students understanding of Plant Nutrition. 'It was found that understanding of the function of food was restricted to a superficial level. They appeared to have little understanding of the role of energy in the maintenance of plant metabolism. This study was conducted on 15 years old students in Britain.

The classroom discussion of social issue by Joan Solomon and Kate Harrison (1990) University of Oxford have collected hundreds of recordings of small group discussions of issues like Kidney transplants, industrial waste and nuclear power. This project is part of a linked research programme on 'The Public Understanding of Science' and is concerned with school age participants.

The project show videoes about issues that raised the personal value positions.

A study on 'An analysis of four ways of assessing student beliefs about STS topics' by Glen S. Aikenhead (1985) investigated four different modes used to monitor student beliefs about science technology society topics :

1. Likert type
2. Written paragraph
3. Semistructured interview and
4. Empirically developed multiple choice

XIIth grade students of Candian urban responded to statements in each of the four modes from views on Science Technology Society. It was found that TV had far more influence on what students believed about science and its social, technological context than other many science courses.

The Likert type responses were the most inaccurate and only a guess at student beliefs. Student paragraph responses contained significant ambiguities in about 50 percent of the cases. The empirically developed multiple choices reduced the ambiguity to the 20 percent level. The semi structured interview was the least ambiguous of all four response modes but it required the most time to administer.

A study on interactions between formal and informal sources of learning science by A. M. Lucas (1987) discussed that people learn science form many sources like schools and other formal institutions, museums etc.

It was found that people with better science backgrounds generally visit science museums, read science news in the press and regularly watch television science programmes.

The possible interaction patterns are as follows :

Formal sources facilitate learning from the informal source. The informal source facilitates learning from formal sources.

* Formal sources inhibit learning from the informal source.
* The informal source inhibits learning from formal sources.
* The efforts may be mutual also. Formal and informal sources are mutually facilitatory.
* Formal and informal sources are mutually inhibitory.
* Formal sources facilitate learning from the informal source, but the informal inhibits learning from the formal. Informal sources facilitate learning from the formal, but the formal inhibits learning from the informal.

In India there is not a single published study on understanding of science. However, three studies. Mathur (1990), Sood (1992) and Kansakar (1996) have been attempted.

Mathur (1990) has conducted a study on the Public Understanding of Science and its relationship with scientific attitude.

In this study the investigator has laid down the following purposes.

1. To study the understanding of science among different groups

of students and public.

2. To study scientific attitude among different groups of students and public.
3. To study relationship between students and other groups regarding their understanding of science and scientific attitude.
4. To find out the effect of parental occupation on public understanding of science.
5. To study the effect of type of school on public understanding of science.

The following hypotheses have been tested in the study :

1. The theoretical mean on public understanding of science scale is higher than the obtained mean of the total sample.
2. There is no difference between different groups of public and students regarding their understanding of science.
3. There is no difference among different groups of students taken from different types of schools regarding their public understanding of science.
4. There is no difference among different categories of students taken on the basis of parental occupation regarding their understanding of science.
5. There is no difference between two groups of students due to sex regarding their understanding of science.
6. The theoretical mean on scientific attitude scale is higher than the obtained mean of total sample.

7. There is no difference among different groups of public and students regarding their scientific attitude.
8. There is no difference among different groups of students taken from different types of schools regarding their scientific attitude.
9. There is no effect of the type of sample on relationship among public understanding of science and scientific attitude.

In this investigation 550 students and public of both the sexes, were selected. Random sampling method was used to select general public as well as schools for data collection.

In this study two instruments have been used namely :

1. Public understanding of Science Scale - developed by the investigator. The test comprises of 18 items. It is a 5 point likert type scale.
2. Scientific Attitude Scale-

   This scale comprises of 36 items. It is a 5 point likert type scale.

The finding have been as follows :

1. The study has indicated that the total sample of 550 students and public has favourable and positive understanding of science.
2. This study has revealed that there was no significant difference between two groups namely students and public concerning their understanding of science.
3. In this study it has been found that there was some effect on

public understanding of science when students from different types of schools were compared, namely :

i) There was significant difference between students from Government schools and students from Private schools concerning their understanding of science. It has also revealed that the students from Private schools possess significantly higher understanding of science than the students from Government schools.

ii) The students from Military schools were significantly better than the students from Government schools regarding their understanding of science.

iii) The students from Public schools possess significantly higher understanding of science than the students from Government schools.

iv) The students from Military schools showed better performance on the public understanding of science scale than students from any of the other schools.

4. In this study the total sample of students was divided into six categories based on parental occupations.

i) This study has shown that the parental occupation does influence the students' understanding of science.

ii) It has been found that the students coming from science related parental occupations are significantly different from the students coming from military services and other types of parental occupations.

5. This study has revealed that there was no significant difference between different groups of students based on sex differences concerning their understanding of science.

The product moment coefficient correlation was used to find out the correlation between public understanding of science and scientific attitude.

The findings are as follows :

1. This study inferred that the public understanding of science and scientific attitude are positively and significantly correlated.
2. There is highly significant correlation found between public understanding of science and scientific attitude in total sample of students and public (N = 550)
3. There is highly significant correlation between public understanding of science and scientific attitude in public group.
4. There is highly significant correlation between public understanding of science and scientific attitude in students groups.
5. It has been found that the relationship between public understanding of science and scientific attitude is not effected by the type of sample.

Another study was conducted by Sood (1992) entitled 'An investigation into the Public Understanding of Science.' The objectives of the study, sample, tools and analysis are as follows :

The objectives of this study were :

1. To determine the levels of the public understanding of Science among different groups.
2. To find out the differences in the public understanding of science, due to different social and educational background.
3. To determine the attitudes towards science among different groups.
4. To find out the differences in attitudes towards science in different groups.

The following null hypotheses have been developed for this study:

1. The Public Understanding of Science of the total sample (N = 308) is less than the theoretical mean.
2. There is no difference in the understanding of science between different groups of people (students and public).
3. There is no difference in the understanding of science due to community type, that is, urban and rural students.
4. There is no difference in the understanding of science due to sex differences.

Some schools were randomly selected from two categories of schools, namely, the public schools and the rural schools. Rural schools are generally Government schools. Secondly, general public was selected from different states of Northern India. The sample was as follows :

Students from Public schools N = 88

Students from Rural schools N = 112

General Public N = 108

Total N = 308

Male N = 234 Female N = 74

The investigator developed two instruments, namely, The Public Understanding of Science Scale and Attitudes towards Science Scale. The first scale comprises 40 Likert type items and the second scale consisted of 20 items. Each item was a three point response format. In each test half of the items were of negative and remaining of half positive response.

The findings were as follows :

The total sample of 308 has indicated that the group has high level of the public understanding of science. It means, the sample as a group possess a high level of understanding on issues such as pollution, environment, energy, healthy living and science with ecological perspective.

Difference between general public and students was also determined. Thus, the data confirm that General public, that is people with higher education, different and diverse background and different geographical locales are much more aware about the socio-scientific issues which influence their living and environment. Issues related energy and radiation are of significance in a country like India. Consequently an understanding of such issues is of much relevance for the nation.

At first sight it is surprising that there is no effect of the quality of education and the social background of the students. Howeever, students of public schools are much, more awakened towards socio-scientific issues. Such issues are also discussed and analysed in school environment and with parents. They are also exposed to concerned literature and multi media.

The test on the Public Understanding of Science has measured (a) Concepts of Science, (b) Science related social issues, and (c) Science with ecological perspective.

This research study has examined the extent of general public and students' attitudes towards science. A thorough and careful examination has revealed that the total sample has favourable feelings towards science. These sub-areas consists of attitudes towards methodology of science, interaction of science with society and opinion about scientists. It is an encouraging finding because as a nation we need positive attitude towards science related activities and scientists.

This study has also revealed that all different groups, independently, possess favourable attitudes towards science. It has also revealed that type of school or classroom climate develops favourable attitudes to science. The sample from Public schools had similar findings.

Another study was conducted by Leela Pradhan (Kansakar), 1996, entitled : 'An Investigation into the Undederstanding of Science and Scientific Temper : A cross cultural study.'

The purposes of this study regarding understanding of science were as follows :

1. To develop and validate instrument of understanding of science.
2. To determine the levels of understanding of science among different groups of pupils from India and Nepal.
3. To study the effect of type of school, class level, geographical locale and sex on levels of understanding of science among students.
4. To determine the relationship between levels of understanding of science and scientific temper.

The hypotheses taken by investigator regarding understanding of science were as follows :

1. Theoretical mean of the total sample is not different than the obtained mean on the understanding of science scale.
2. Students from India and Nepal are not different on the understanding of science scale and on its dimensions.
3. Students of different classes are not different on the scores of the understanding of science scale and its dimensions.
4. Students of different groups are not different on scores of understanding of science scale and its dimensions due to class level differences.
5. Students from urban and rural schools are not different on the scores of the understanding of science scale and its dimensions.

6. There is no significant effect of class level, geographical location, type of school and sex of students on coefficient of corelation between scores of understanding of science and scientific temper.

The findings of the study were as follows :

1. The total sample of students from India and Nepal (N=1315) has favourable understanding of science. It was also inferred that the total sample has favourable understanding of scinence concepts, science policy perspective. Incidently, understanding of science among students was not highly favourable on dimension value judgement.
2. It was found that students from Nepal (N=705) possess significantly higher understanding of science than the students of India (N-610). Students form Nepal had significantly higher understanding of science concepts, science policy perspective and value judgement dimensions.
3. It was indicated that students from Xth class do not signicicantly differ from students of XIth class on their understanding of science.
4. Similarly, male and female students do not differ significantly on their understanding of science. It is also true in case of three dimensions of the scale.
5. It was revealed that students from schools situated in urban

localities possess higher understanding of science than the students from schools situated in rural areas. It is true on the three dimensions of this scale also.

6. It was indicated that the students studying in private schools has higher understanding of science than students from Government schools. It was also revealed that the students from private schools in Nepal possess higher understanding of science, the students from private schools in India were not different from the students of Government schools concerning their understanding of science.

7. There is significant difference between secondary and senior secondary students from Nepal in their understanding of science. Senior secondary students possess higher understanding of science. But their counterparts in India were not significantly different in their understanding of science.

8. It was indicated that the secondary and senior secondary students from Nepal and India differ on their understanding of science and students from Nepal possess much more favourable understanding of science.

9. It was indicated that male and female students from India and Nepal independently do not differ significantly concerning their understanding of science.

10. It was indicated that the students from urban and rural schools differ in their understanding of science. This is true for the

students from both India and Nepal. The students from urban schools possess much higher understanding of science. But students from rural schools of India and Nepal do not differ in their understanding of science. Students from urban schools of India and Nepal differ in their understanding of science.

11. Students from Government schools of Nepal and India differ on their understanding of science. This is also true to students of private schools.

2.3 Studies Related to Scientific Temper

Science is an on-going, dynamic and humanistic process. The impotance of helping people understand the dynamic nature of science, is essential. As our world continues to become increasingly rooted in science and techonology, citizens will use such knowledge in their daily lives with increasing frequency. When science has become and integral part of contemporary socio - cultural milleu and many science technology related issues can be solved only by applying scientific thinking, scientific ethos and methods of science, becomes essential to develop scientific thinking among the people. It also includes the development of scientific attitude and scientific way of thinking and action. Scientific attitude includes both opinion about science and those traits of the mind which gives impetus to curiosity, rationality and objectivity. Scientific attitude is a mental disposition with regard to looking at things objectively and rationally. It includes traits such as open mindedness, curiosity, suspended judgement, objectivity, honesty and humility.

Much research work has been attempted in conceptualizing and getting empirical evidences on scientific attitude. Starting with Curtis (1924), Noll (1935), Davis (1935), Ebel (1938), Lampkin (1938), Honey (1964), Harris W. Chaster (1966), Diederich (1967), Jain (1976), Kozlow and Nay (1976), Fleming Joseph (1979), Srivastava (1980), Vyas (1981), Golwalker (1978), Ramachary (1982), Sanadhya (1986) have studied conceptual aspect as well as development and measurement of scientific attitude.

It appears, contemporary scenario as related to science technology and society, is different specifically in the developing countries. Developing countries suffer from illiteracy, traditionalism, and conventional way of thinking. These countries are increasingly encouraging the growth and development of science and technology. Thus on one hand science is a mysterious thing and scientific thinking is far away from them and on the other science has become the source of development. Goswami (1984) has very mentioned :

India, really is a land of contrast. Here, the high science and technology of space and electronics go hand in hand with the bullock cart, atomic energy goes side by side with cowdung burning, highly sanitary conditions and nutritious food in big hotels go along with the stinky slums where penniless, jobless dwellers live in a primitive state. But the fruits of science and technology have percolated not only to the sophisticated urban life but to the simple life of the remote village which outwardly looks undisturbed by the change. The man in the remote

village also occasionally listens to the radio, uses a contraceptive device, swallows a tablet, sprays insecticides, takes a bath with a cake of soap, rides a bicycle and a bus and receives a telegram. He may even be luckier and be able to see an instructional telecast, or a movie shown by a social welfare body that encourages him to get his children inoculated and vaccinated, to sow a high yielding disease resistant variety of seed in fields or to get his wife tubectomised.

The course of science and technology has also touched the life of almost every Indian (like his counterpart in any other part of the world). The shock of rapid change and the unmanageable emotional adjustments, the ill effects of land, water and air pollution, the tilted balance of the ecosystem - all have echoed and re - echoed in his life either in an urban or rural environment.

Thinkers have agreed that the masses should adequately interpret science and scientific thinking. Many a times, it has been observed that the students and public may know what these styles of thinking are, but may be quite unwilling to adopt them as their own : that is they may have negative attitudes to these 'scientific attitudes' (Schibeci, 1984). Thus the attributes such as open mindedness, tolerance of the views of others, objectivity, and rationality (which are also known as attributes of scientific attitude) have not been taken as a way of thinking and action. Therefore, a more generalised view of scientific attitude has to be inculcated among the people. This has been taken as scienctific temper.

It is now well accepted that the continuation of a medieval outlook and value system and social norms have been a hinderance to the development and integration of developing societies. The sixth five year socio - economic plan (1980-85) in India has mentioned.

> The task of creating scientific temper is a vital necessity for the growth of science and its utilisation in the development process. There is need to create scientific climate and involve the people in discussion on various issues of science and technology which affect their life. There has to be dissemination of knowledge about natural phenomena and technological innovations through popular science journals and other media. There is also need for promoting public debate on major issues on science and technology. The full potential of science has to be utilised for eradication of irrational attitudes, which tend to hold back the nation from the path of progress.

India has distinctly accepted the development of scientific temper as one of the objectives of education. But there are limited studies in this field of research.

The investigator could find only four studies on scientific temper. These studies have been attempted at Ph. D. and M. Ed. level. Singh (1990) has attempted Ph. D. research entitled 'Scientific Temper and Education'; Sharma has attempted M. Ed. (unpublished, 1991) entitled ' A study of the Scientific Temper of students of senior higher secondary schools; *Dubey K. K. 1992* conducted a study entitled 'A study of the scientific temper and its measurement.' The investigator has pointed in his study that whereas the measurement of scientific temper is a real problem, its development is regarded as one of the most important goals of school science education. Me said that the present study attempts at the measurement of scientific temper.

The objectives of the study are as follows :

i) To develop a scale for measuring scientific temper along with its appropriate working definition and determination of its ingredients using factor analysis and

ii) to compare the incidence of scientific temper as judged by scores on the scientific temper test among different groups of teachers and students, such as male and female, urban and rural and science and non-science students as well as teachers.

The methodology used in this study is a two-stage stratified sampling method to select class XI science and non-science students. It also included two groups of teachers, i. e. science and non-sicence teachers. The scientific temper scale devised on the Likert method of summated ratings was used to collect the data.

The major findings of this study are as follows :

1. All the groups of students and teachers manifested scientific temper.
2. Significant differences in scientific temper were noticed between male science teachers and male non-science teachers; female teachers and male teachers, rural girls and urban girls, urban boys and urban girls and finnaly male science students and female science students.
3. No significant differences appeared between female science and non-science teachers as well as science students and non-science students.

4. The mathematical structure of tools and tasks as used in this study showed the existence of two factors, namely, curiosity and aversion to superstiions.

Another study was conducted by Leela Pradhan (Kansakar), 1996, entitled 'An Investigation into the Understanding of Science and Scientific Temper : A cross cultural study.'

The objectives of this study regarding scientific temper were as follows :

1. To develop and validate an instrument on scientific temper.
2. To study the levels of scientific temper among different groups of pupils from India as well as from Nepal.
3. To study the effect of type of school, class level, geographical locale on leveles of scientfic temper and
4. To determine the relationship between levels of scientific temper and understanding of science.

The following hypotheses regarding scientific temper were tested in the investigation :

1. Theoretical mean of the total sample is not different than the obtained mean on the scientific temper scale.
2. Students from India and Nepal are not different on the scientific temper scale and on its dimensions.
3. Students of different groups are not different on scores of scientific temper and its dimensions due to class level difference.

4. Students of different sexes are not different on the scores of scientific temper and its dimensions.
5. Students from urban and rural schools are not different on the scores of the scientific temper scale and its dimensions.
6. Students from different types of schools are not different on the scrores of the scientific temper scale and its dimensions.
7. There is no significant relationship between scores of understanding of science scale and scores of scientific temper scale.
8. There is no significant effect of following on coefficient of corelation between scores of understanding of science and scientific temper.

i) Class level of students.

ii) Geographical location of students.

iii) Type of school of students and

iv) Sex of students.

The sample of the study were selected by random sampling procedure. The sample comprises students studying in Xth and XIth classes from India and Nepal and the total sample includes 1315 students.

The findings were as follows :

1. The total sample (N=1315) has above average scientific temper. The sample has positive and favourable value perspective, it has aversion to supersition, favourable attitude towards science

and has constructive world view about science and its role in developing a balanced world.

2. It was indicated that the students from Nepal reflect bigher level of scientific temper than the students from India. These two groups significantly differ on different dimensions of scientific temper, that is, Value Perspective, Aversion to Superstition, Attitudes towards science and a World View Perspective.

3. This study has reflected that senior secondary students possess much more favourable scientific temper in comparison to secondary school students. It was also indicated that senior secondary students possess higher level of value perspective, aversion to superstition, attitude towards science and a world view perspective.

4. It was indicated that there is no difference in the level of scientific temper due to sex differences. But there was significant difference between male and female students on a world view perspective. Male students' thinking was on the higher side.

5. It was revealed that the students from the schools situated in urban areas has much higher level of scientific temper than the students from schools of rural areas. This is true on the all four dimensions of Scientific Temper Scale.

6. It was indicated that the students from private schools possess high level of scientific temper than the students from Government schools.

7. It was inferred that the secondary students from Nepal possess high level of scientific temper than the secondary students from India. But the secondary students from India prossess high level of attitudes to science in comparison to secondary students from Nepal.
8. It was observed that the senior secondary students from Nepal has high level of scientific temper than the senior secondary students form India. But there was no difference in these tow groups on dimension a set of attitudes.
9. It was observed that the male students from Nepal has high level of scientific temper than the male students from India.
10. It was revealed that the female students from Nepal has high level of scientific temper than the female students from India.

Singh (1990) has defined scientific temper as follow :

"For operational purposes, scientific temper would mean a value frame, an outlook for the world and an approach to one is world of deeds and action."

The investigator has determined the role of education to cultivate scientific temper. According to him education plays a liberating role in changing economically determined and socially conditioned attitudes of teachers, and teacher education can cultivate, 'Scientific Temper' in the prospective teachers, despite level of development and such was the presumption. Since the only criteria of educational development of the

teachers could be their educational background, it came to light that their achievement level is more or less the same, except for a few variations.

Hypotheses of the Study :

1. Level of scientific and technological development determines the perception of a society.
2. Teacher pick up their attitudes from the society they belong to.
3. Education plays a liberating role in changing economically determined and socially conditioned attitudes of teachers.
4. Scientific Temper is an attitude and a world view which is positively correlated with the development of society.
5. Teachers' attitude is an indicator of level of development and level of liberation as correlates of 'Scientific Temper.'
6. Teacher education can cultivate 'Scientific Temper' in the teacher - learner despite level of development.

Findings of the Study :

This diagnostic study, reflacts the mental and projective formations, in the teachers of higher secondary schools, of Kanpur District as the human component of educational system. The method adopted in sampling data collection and analysis have been portrayed, and the synthetic view sums up the study by bringing out the blocks, which handicap the teachers in a perception, conducive to critical thinking, rational approach, scientific method and above all scientific temper. Negations of scientific temper in their mental make up should be negated

and positives have to be re-inforced in the interest of the educational system. Hypotheses were six in numbers which were reorganised into 1 and 2 as one unit, 3 and 6 as the other and 4 and 5 as the third unit, for inspection and enunciation of the qualitative study.

Technology, Society and Teachers

The first set suggests estimation of the interplay of technology, society and teachers. The two types of samples, from rural and urban Kanpur represented two levels of technology in the District. Perception of the teachers while estimating their attitudes, did not reflect an equally different type of attitudes on this score. Rural and urban teachers in the sample were categorised on the basis of scores and the rural born and working also in rural areas did not have share in one category or some specific categories only. Another indicator of use of technology possibly, lies in the economic capacity of the family of origin. There has been a marked difference in the attitudes of those teachers whose parents were illiterate regarding their aspiration for the education of their children. So they feel that they should be able to do their maximum towards the better bringing up of their off springs. A third level check up was made available from the data through the tools, about the perception of the teachers of the profession they belong to, their academic satisfaction and the difficuld, if any, faced by them in securing the first job and promotion. Responses about these items are also clear in uniformity without the portrayal of level of science and technology gets minimal reflection in the attitudes of the teachers. The assumptions are not

supplicated by the data and results. if there is any difference, it is in the context of definitely positive perception about the future of their children in a growing dimension of changing society.

Education and Cultivation :

Education plays a liberating role in changing economically determined and socially conditioned attitudes of teachers, and Teacher Education can cultivate 'Scientific Temper' in the teacher- learner, despite level of development and such was the presumption. We saw the role of education per - se, before getting into teacher education. Since the only criteria of educational development of the teacher could be their educational background, it come to light that their achievement level is more or less the same, except for a few variations, when a very marginal number is very high achiever and few at the bottom. Equally dispersed in the categories, they prove that education as such has played its role to make up their attitudinal profile. However, those teachers who got the advantage of orientation and training programmes are certainly different than those who did not get the advantage. This second level training is upheld by data, the first level is compulsorily obtainable in the teachers. Both the factors of education and teacher education get upheld and sustained. Obviously, there could be difference between the uneducated and the educated which we did not check up.

Levels Available

We tried to understand hypotheses four and five and developed items for tool two, to estimate attitudes (the value frame) the world view,

and for their being teachers as liberated individuals in the educational system, the teaching learning component of the questionnaire. The highly loaded category XIV, both individually and collectively, of the responses on these three variables in tool two suggests the preponderance of the medium image. When we took up the study, we were not sure of such a level of performance. There has been in the air an opinion that the Indian society has been traditional, loaded with dogma and obscurantism. Different religious groups, caste groups and urban/rural groups have their share in this category, as in the category I and XXVII. Certainly, scientific temper is at different levels with respect to the categorisation of teachers but none of the off quoted statements are upheld by our data, which could put us up against the set up in which teachers are being nurtured. This aspect of the theses may be repleted in other studies to sustantiate the arguments in districts other than Kanpur, since each district differs in its artifacts. The value frame thus discovered in our sample is a case where rural - urban differentials have upheld the continum principle, religious, caste and community differences are minimised by educational intervention, and scientific temper is an equitably shared culture amongst the teachers, depending on their level of alround development as human beings.

So far so good about the hypotheses that we had set and synthesized for qualitatively interpreting the data. We did undertake a study of women teachers as a separate exercise, so as to find out their

situation in the whole study. Women teachers, almost a representative sample of educated women in the society, have proved in the study that they are alround better achievers, performers and more satisfied, accountable by generally belonging to educated parents and better off families. Also, with respect to belongings, they show higher level of possessions, including their own transport as scooters. They did not face difficulties in securing their jobs, casteism and communalism has been reckoned by them as a factor creating problems. But this has to be seen in far wider terms than this study provides. We check up these problems as survivals, revivalism has to be measured by subsequent studies, as an intervening variable. One significant aspect failing out of the study is the perception of female component, about the status of the teacher in the society. Women have generally ranked wealth and social - political influence as two criterion at top levels. This shows that women find themselves handicapped because of these factors in a society more conducive to other than professional competence as determinatnts. The theses in this aspect provides a latest indicators for women studies.

The Blocks

The tool to test the scientific temper brought the categories in descending orders. There were HHH performers. MMM performers and LLL performers. They are without contradictions teachers in their straight perceptive profile. However, the combinations of HML give a very different category of double jumps as described in the synthetic portrayal of the data. These are the cases which gave us material to understand the

reason of such double jump and these we called blocks. These blocks are primarily socially conditioned nothing to do with level of technology. Casteism, communalism and the culture of differentials in wealth have provided one set of blocks. It is obvious that the differential logic regarding these factors as observable in society must get feflected in the desparate view.

However, our work takes note of three dimensions, cognitive, affective and conative aspects of the professionals, as teachers. The mental block regarding cognitive domain comes from lack of information and correct knowledge about two aspects one is the understanding of reality behind the myths that influence them from early socialisation. The second one is their lack of comprehension of the concept 'citizenship of the earth.' If one is an understanding of ancient and its survivals in science of India, the other is designed to take strides with all that which is not yet a common message in ecosystem approach. In the affective domain, this group of mental blocks redeems one level data to substantiate absence of critical appraisal and scientific method in pursuing the observance of what was conveyed to them in their receptive formative stages. The third area is the conative or work situation. Generally there is a poverty, more reflected in block formations when high achievers otherwise become low performers in teaching learning. In this tool, teaching learning is a part of the compendium of three sections. A teacher world only be as liberated a person as he/she is able to liberate the children. And certainly, the factor is the outcome of one's

perception of the past in retrospect and connected with the future and at the mid point sees the present. This requires an outlook, which is not their fault, either. If teaching learning is an outcome of a training programme, it should highlight the totality of the things in situational context to develop the appropriate outlook for the equally desirable efforts as teachers. There are born teachers and we cannot depend on this natural gift only.

General Conclusion :

While discussing the components and their inter play in the sample we did see the interaction and their reflact on the sample. Following is the presentation of conclusion arrived at.

a) The highest categories in values, teaching learning and world view start from the scores 75, 71 and 75 respectively. Therefore, it is concluded that in high categories, scores are almost at equal level. The medium categories, however, for values is for scores 56 to 74 in teaching learning, for 52 to 70 and 65 to 74 for world view. This is to conclude that drop in score in world view is much lesser than the corresponding drop in teaching learning and values. Similar is the trend in the low categories.

b) The above trend is reflected in the relationship of these three ingredients : between values and teaching learning and world view. Between values and teaching learning the relationship is linear, both in low and high regions of values. In its medium region, the teaching learning score is almost constant. However,

the world view drop in the lower region is at much lower rate than the drops in values and teaching - learning.

c) We conclude that there is a positive relationship between these three ingredients of scientific temper. However, since for the high achievers the scores are almost the same, remedial measures are required for the relatively medium and lower category people in their value and teaching learning domains, although as interdependent ingredient world view is to be over all improved, for all the teachers so that the logic of the 'citizenship of the earth' gets scientifically and technically opened up.

2.4 Implications for This Study :

A review of the related studies have been attempted in this chapter. It appears that the concepts of understanding of science and scientific temper have not be studied by many researchers. Undoubtedly, there are many studies on scientific attitude both abroad and in India but there were only three unpublished studies on the understanding of science and four studies on scientific temper. Some of implications for this study are as follows :

1. Contemporary socio-cultural scenario in Inda needs empirical evidences on the development of the understanding of science and scientific temper.
2. Socio-cultural scene in India reflect wide and varied contrast which necessitate the significance of inculcation of scientific

temper based upon adequate research based feedback.

3. There is not a single cross-religion study on the understanding of science and scientific temper.
4. Ther is paucity of conceptual ideas on scientific temper.
5. It is evident that an adequate understanding of science will generate scienfific thinking and scientific temper among the people. It is implied that the cognitive aspect of the understanding of science will help in inculcating affective aspect of scientific thinking.

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CHAPTER III

METHOD AND PROCEDURE

3.1 Method

In the present study descriptive survey method has been used. The term survey suggests gathering of related evidence to current conditions. Survey research is a method of collecting and analysing data from large number of respondents representing a specific population (Dallen, 1971).

3.2 Sample

The sample of the study was selected by random sampling procedure. In other words, this sample is representative of the whole population. In this study students of both the sexes from different geographical locales have been selected randomly. Random selection is a process by which every element in the population has an equal chance of being chosen in the sample and the same was adopted for the present study.

The sample comprises Hindu and Muslim students studying in 9th and 10th classes. The total sample includes 1000 students and its distribution is as follow :

TABLE 3.1

SAMPLE DISTRIBUTION (N = 1000)

Religion		Geographical Locale		Class		Sex	
Hindu	Muslim	Urban	Rural	9th	10th	Male	Female
600	400	800	200	660	340	650	350

Salient Features of the Sample :

The investigator has selected sample in accordance to the need of the study. This study is meant to determine the levels of understanding of science and scientific temper among the students. This sample has following characteristics :

1. Students from two different religious background, namely Hindu and Muslim have been selected.
2. Students from different academic background have been selected.
3. One group of students (class IX students) have studied science for nine years in school, which is a sufficient period to inclucate scientific temper.
4. This sample comprises both male and female to determine sex bias, if there is any, due to formal education.

3.3 Research Design

There were five independent variables, each has two levels. Therefore, the research design for this study has been factorial design. The five independent variables has been as follows :

1.	Type of Religion	:	Hindu and Muslim
2.	Class level	:	9th and 10th
3.	Type of School	:	Government Schools and Private Schools
4.	Geographical locale	:	Urban and Rural
5.	Sex	:	Male and Female

The dependent variables of the present investigation has been:

1. Understanding of Science and its Dimensions
2. Scientific Temper and its Dimensions

Procedure for Analysis :

Data has been computerised and following calculations were made :

1. Mean and Standard Deviation
2. Critical Ratio test for significant difference between means
3. Coefficient of correlation

With the help of above statistical treatments, inter group comparison and relationships have been tested.

3.4 Variables and their Measurement

The study involved measurement of two variables the Understanding of Science and Scientific Temper. The independent varialble religion was taken in the form of intact religious groups of Hindu and Muslim students. The two dependent variables were measured by Understanding of Science Scale and Scientific Temper Scale, developed

by Leela Pradhan (Kansakar) 1996. The details of these two scales are presented.

3.4.1 Understanding of Science Scale

The understanding of science and technology related issues are essential for thoughtful decision as well as for personal well being of all citizens. The understanding of science is a concept which reflect the adequate comprehension of basic scientific concepts.

The survey of the related literature has revealed that researchers have attempted some of the significant studies related to the nature of science. Such studies have been conducted in the U. S. A., Australia and India. But little research effort has been made on the understanding of science.

Understanding of science, as a field has recently gained popularity and attempts have been made in Britain to determine the level of understanding of science, taking one or two specific elements of science at a time. In India, limited attempts has been made.

Understading of Science : A Theoretical Framework :

Significant social changes have occured since world war II. During the post world war period there has been significant interaction of science, technology and society and formal education is introducing students to the ways and means of democratic participation in the context of science technology social related issues. Therefore, the public perception of science has changed dramatically. Consequently people

are aware of many diverse issues such as environmental awareness, development of nuclear bomb, antibiotics, harmful effects of insecticides and cleaning atmosphere from radiation fall out.

Most thinking people would agree that there is a need of understanding of science so that people can play positive role in building bridges between science and society. But it appears that we have to go a long way to achieve such objectives. Bhopal Gas Leak Tragedy in 1984 has clearly indicated that understanding of science would have saved many lives from such industrial disasters. In 1990 a national newspaper in Britain ran a poll which revealed that over 80 percent of people questioned disapproval of genetic engineering but fewer than 10 percent new what it was. Therefore, it is imperative that public should have adquate understanding of science related social issues. Hodson and Reid (1988) has very aptly mentioned :

> If we genuinely seek an informed and thinking citizenry capable of considering scientific and technological matters in the context of economic constraints, environmental issues, ethical concerns and social and aesthetic considerations we must include in our science curriculum a consideration of the impact of science and technology on society and the influence of society on science, scientific research and scientific development.

The investigator feels that the understanding of science should comprise a composite picture of different dimensions of science and society which will serve as a vehicle for the development of personal and social skills for making reasonable decisions on such issues. Therefore, three dimensions of this scale have been finalised which are as follows :

I) Concepts of Science

II) Science Policy Perspectives

III) Science Value Perspectives

A brief description of these three dimensions has been presented.

I- Concepts of Science :

Science has an ever increasing fund of scientific knowledge comprising facts, principles and generalizations of science. This vast scientific knowledge is to be presented through such terms which convey an appropriate meaning. These terms are known as concepts, major ideas or major points. Technically, 'a concept is an abstraction of a class of events, objects or other phenomena having common attributes.' Similarly, Tarrooll (1964) defines, "a concept is an abstraction of a series of experiences that defines a class of objects or events."

The investigator has assumed that understanding of science comprises learning of scientific information which will give scientific awareness about major ideas of science. Some of the items, selected in this instrument, which represent this dimension, are as follows :

2. Use of solar energy can solve fuel problems.
9. Nutritional food is essential for healthy living.
10. Use of tobacco is injurious to health.
11. Software is a term used in computers.
12. Genetic engineering Research should not be promoted.
13. Computer virus is a dreaded disease.

16. Depletion of ozone layer will not create any environmental disaster.

II- Science Policy Perspective :

Science and technology have made enormous progress. They have produced many marvels and conveniences during this period of time. Science and technology have also many socially undesirable aspects. In both the cases, there is a need to take policy decisions. These decisions will balance the benefits and problems given by science and technology. How these policy decisions influence growth of science and technology is evident from programmes related to the use of manure in fields, computer in research and peaceful uses of atomic energy. Policy decisions related to satellite communications, nuclear fusion, biomedical applications, recombinant DNA the use of pesticides and insecticides, drug use and abuse, pollution and population growth are such problems which need attention.

This dimension has included items, such as :

21. Population growth must be curbed to avoid depletion of scarce resources.
23. Mass media has no effect in educating masses on population issues.
24. A nation that destroys its soils, destroys itself.
25. Destruction of forests does not increase imbalances between man and environment.

III- Science Value Perspective :

It is true that concepts of science and policy decisions on science are of immense utility for all of us. But science as an integral part of culture and its acculturization role has most significant meaning in the whole process. Science should develop personal and social values to reflect aesthetic, humanistic and practical values.

Values of science necessitates for independence of thought, use of rationality, acceptance of failure and unsatiable desire to search new knowledge and ideas. In this instrument, simple values such as questioning attitude, cause and effect relationship have been included. Some of the items included in this instrument are as follows :

37. Suspended judgement has no relevance in scientific findings.
38. There is no need to challenge authority.
40. There is no use in seeking cause and effect relationship explanation.

Instrument's Validity

The most important consideration in judging the adequacy of a test is its validity. Instrument reliability is necessary, but not a sufficient condition for instrument validity. Being reliable is part of being valid or to measure something consistently is to be measuring something. An instrument is valid if it measures what it is being used to measure. Thus, there are potentially as many types of validity as there are measurement purposes to which an instrument can be applied (Munnally, 1967).

Two major classes of instrument validity are identified.

1. Content validity
2. Construct validity

Content validity is concerned with the representativeness of an instrument's subject matter. It is a matter of judgement. Each item in an instrument must be studied and its relevance to the measuring goals are to be evaluated. This procedure is most efficiently accomplished during instrument development. (Cronbach 1970, Kerlinger 1973, Munnally 1967). It is not possible to draw all items for the factors being assessed so a random sample of items from the content was selected. The content validity of understanding science scale was judged during instrument development. The instrument is based on definitions of understanding science. In addition to this the content validity of each item was also calculated by Lawshe (1975) method and the item having CVR below 0.62 were rejected.

Construct validity concerns the extent, to which a test tells us something about a meaningful characteristic of the individual. Testing the construct validity of an instrument is testing the theory behind the instrument. The instrument is ability to differentiate between the two groups can be evidence of its construct validity. An instrument can be relevant to establishing its construct validity if the test items are expected to inter correlates i. e. finding (substantial) correlations between the test scores to the total scores. The instrument would then have predictive power in those situations which are defined by its items (Cronbach and

Meehl 1966). The same procedure was adopted to calculate the construct validity of the instrument.

Inter correlations between the three dimensions of understanding of Science and correlations of these dimensions to the total score of the different groups of samples were calculated. These correlations are shown in table 3.2.

Instrument's Reliability

Reliability is defined as the consistency with which a test measures what ever it measures. It is the ability of instrument to yield consistent results from one set of measures to another. It is the extent to which the obtained test scores are free from random error. Munnally (1967) has outlined major sources of error which can threaten instrument reliability. The major sources of random error within an instrument include item sampling, item ambiguity, subjective scoring and respondent guessing. Many of these errors may be overcome during the construction of the instrument. Whenever we give a test there are many factors which enter into the error component of an individual score. Some of these are guessing, misleading an item, daily fluctuations in an individuals health, emotional status and many physical factors. The size of this error component is related to the reliability of any measuring device. The smaller than error component on error score, the more reliable the instrument. In its simplest form reliability means consistency. A reliable instrument leads to measurement units which also fairly similar from time to time

There are a number of techniques used in the computation of reliability co-efficients. Each technique assesses the influence of one or more of the major sources of the random error which can effect an instrument. Coefficient alpha is the basic formula for determining instrument reliability as it is effected by the instrument's internal consistency. Munnally (1967) suggests that it be the first reliability estimate calculated for every instrument. The split-half-method is another method of testing insrument's reliability which measures instrument's internal consistency. The split-half-method assess sources of random error within an instrument by correlating results on two halves of an instrument. The split half correlations can be made for any one instrument as there exist ways of dividing the instrument in half (Anasbasi 1961 and Munnally 1967). Instrument reliabilities of at least 0.75 are wanted. For the purpose of applied research where important decisions are made with respect to specific test sores, a reliability of 0.90 or higher is desirable for instrumentation. (Anasbasi 1961, Munnally 1967, Kerlinger 1970).

The calculation of coefficient alpha yields internal consistency coefficient. The reliability of instrument understanding of science scale was also computed by statistics called standard error of measurement. This statistic is not affected by the range of scores of the sample tested. This standard error of measurement is the standard deviation of a sample of scores of an individual about his true score. For the present calculation of standard error of measurement Lord (1959) fromula was used. The

reliability as computed by this method was found to be 0.842 of understanding science scale.

TABLE 3.2

RELIABILITY COEFFICIENT AND COEFFICIENT OF CORRELATION DIMENSIONS OF UNDERSTANDING OF SCIENCE SCALE

Dimensions	Reliability Coefficient	Total score	Science Policy ii	Value Judgement iii
i. Science Concept	0.703	0.759	0.243	0.259
ii. Science Policy	0.678	0.715		0.306
iii. Value Judgement	0.582	0.616		

From the table 3.2 it is evident that reliability coefficient for dimension Science concept is 0.703, and for dimension Science Policy is 0.678 and for value judgement dimension 0.582. The table further reveals the coefficient of correlation with total scores and dimensions of the scale. All the calculated coefficients of each dimensions with the total score are high and positive. The correlation coefficients between dimensions are low. The high coefficients of correlation with total scores and weak correlation with in the dimensions justify the inclusion of these dimensions in the scale, leading to high construct validity of understanding of science scale.

Final form of Understanding of Science Scale

The final form of understanding of science scale consists of 40

items measuring understanding of different dimension of science. The following table 3.3 shows the number of items and their polarity in each dimension of understanding of science.

TABLE 3.3

DISTRIBUTIONS OF ITEMS IN EACH DIMENSION AND THEIR POLARITY

Dimensions	No. of Items	Positive Polarity Item No.	Negative Polarity Item No.
i. Concept of science	20	1, 2, 9, 10, 11 14,15,17,18,20	3, 4, 5, 6, 7, 8 12, 13, 16, 19
ii. Science Policy	15	21,22,24,27,28 30,31,33,34	23,25,26,29,32,35
iii. Value Judgement	5	36,39	37,38,40

3.4.2 Scientific Temper Scale

It is not easy to define science because it defines its own definition. James B. Conant has defined science as an interconnected series of concepts and conceptual schemes that have developed as a result of experimentation and observation and are fruitful of further experimentation and observations (Conant, 1951). Later on thinkers related science with inquiry and social aspects of society. Science has been taken as a human activity with a concern for scientific knowledge (certain facts, principles and theories worth knowing), a concern for the processes and methods of science reasoning and investigating direct

experience of scientific activity appreciation of the complex reltionship between science and society and fostering positive attitudes towards science (Hodson, 1985). Scientific thinking stemmed from curiosity about natural phenomena, humility and skepticism, objectivity and scientific inquiry and processes.

Scientific thinking has given new direction for developing objective and independent thinking among the people. It has been also known as scientific attitude which reflects humility, objectivity, curiosity, avoidance of dogmatism, willingness to consider new data, and the positive approach to failure. These tenets of scientific attitude influence the thinking of people. John Dewey in 1934 observed that every course in every subject should have as its chief end the cultivation of these attitudes of mind, open mindedness, intellectual integrity, observation and testing their opinion and beliefs that are characteristics of scientific attitude. The first attempt by was Davis (1935) Ebel (1938) further tried to define scientific attitude and also determined its components. Scientific attitude and its inculcation became objectives of education in general and specific in science education.

The Nature of Scientific Temper :

Since the acceptance of philosophical and sociological perspectives of science, scientific attitude gained significance. But a wider perspective was given to this term as *'scientific temper'* when understanding of science and scientific thinking became our integral part of formal as well as non-formal system of education. These two

terms scientific attitude and scientific temper differ in their generality and the difference is very subtle.

Natioanl Policy on Education - 1986 has mentioned that, "Education has a acculturating role. It refines sensivities and perceptions that contribute to national cohesion, a scientific temper and independence of mind and spirit - thus furthering the goals of socialism, secularism and democracy enshrined in our constitution."

Scientific temper has pervasive implications as related to objectivity, rationality and as a way of thinking and acting. Scientific temper is a part of a thinking human being who tries to use his mental abilities to decision making in every day life activities. For the purposes of this study we can say that, scientific temper is a unified state of mind comprising thoughts, action and conduct of an individual in a specific situation. Scientific temper is a process of thinking to act objectively, rationally based upon available evidences at the time of making decisions.

Measuring Scientific Temper :

It is not easy to measure scientific temper as it reflacts the cognitive and affective modes of thinking. But it can be observed and measured while we observe the reaction, behaviour of the person as related to some incidence or situation.

In educational perspective, scientific temper is to be measured so that teaching and learning can be equipped better to inculcate this state of mind or this pattern of thinking.

Though there are a good number of tools to measure scientific attitude, the area of scientific temper still needs exploration and testing for the development of a reliable tool.

Scientific Temper : A Theoretical Framewrok :

A sensible and balanced view of science education is dependent on the development of much awareness about values of science and scientific thinking and their role in society.

The scientific approach and temper are or should be a way of life, a process of thinking, a method of acting and associating with our fellowmen. The scientific temper point out the way along which man should travel. It is the temper of a freeman.

Scientific temper is cognitive and affective aspect of the personality of a person. Scientific temper is a value based process to look at things and events. It is similar to scientific thinking. Scientific temper is a unified state of mind, comprising thoughts, action and conduct of an individual in a specific situation. Scientific temper is a process of thinking to act objectively, rationally based on available evidences at the time of making decisions.

There are four dimensions that reflect the views and beliefs on scientific temper. These are as follows :

I) Value perspective

II) Aversion to superstitions

III) A set of attitudes

IV) A world view perspective.

A brief description of these four dimensions has been presented.

I- Value Perspective :

Science provides a powerful way of investigating and understanding the world. It is related to the problems of everday living and stress practical skills, decision making and problem solving. The values of science as a way of investigating and solving problems as well as enhancing decision making among individuals have long been recognised. Value systems and ethics are not peripheral to science and technology but constitute their very basis and driving force. Hence the shift to balanced socio-economic system will require a corresponding shift of values from self assertion and competition to co-operation and social justice, from expansion to conservation and from material acquisition to inner growth (Capra, 1982). These values provide energy leading to liberating and enriching experiences. Science and technology have a significant capacity to shape nearby every aspect of human experience including social structure and personal and cultural values.

This value perspective will help in solving science based personal and social problems. A set of values as related to science and scientists have been objectivity, rationality, inquiring mind, intelligent decision making, insatiable curiosity, ingenuity, perseverance and internal drive to find out the unknown.

The investigator has taken scientific temper as a unified state

of mind, comprising thoughts, action and conduct of an individual in a specific situation. It is possible if we look at things with objective and rational attitude.

In this socially polluted environment, the value perspective dimension of scientific temper should be observable in the behaviour of the people, then only we can strive for a just and honest society, Some of the items in this dimension are as follows :

2. I take interest in the investigation of new ideas.
4. My decisions are influenced by the opinion of others.
6. I beliveve in intelligent decisions based upon findings.
9. Beliefs given by parents should be accepted.

II- Aversion to Superstitions :

A conventional society generally suffers from age old beliefs and superstition. Illiteracy and ignorance further strengthen these beliefs and faith in super natural powers. Such faith in super natural powers increases dependency on luck and give mental resistance to new ideas. Sometimes happening such as earth quake or diseases like plague are taken as an displeasure of some diety.

India has traditional societies, though approximately sixty five percent of the population are literate, have accepted scientific thinking as a way of action and thought. Yet age old beliefs continue which are reflected in the behaviour of the people from time to time. How far science education has erased such beliefs is a question to be tested ?

A person with scientific temper shall not subscribe to superstition or old beliefs. A person with objective analysis will determine the worth of any unnatural event through analysis based upon evidence. The investigator has taken some items to determine this aspect of scientific temper.

11. Failure in examination is due to bad luck.
20. I consult astrologers to predict weather.
22. Falling of astroids in sky is a sign of bad luck.

III- A Set of Attitudes :

A person with scientific temper reflects a set of attitudes towards environment, cultural context, science, scientists, use of technology and world view. These attitudes are observable in the behaviour of the person. These attitudes rflect opinion about the use of science and role of science in society.

In India farmers have accepted the use of science and technology to increase their form yield and achieved the maximum growth. But how far these people reflect faith in scientific research for such purposes is a question to be tested. The investigator has taken these items as a part of scientific temper scale.

23. Use of science and technology have polluted biological environment.
25. Accepting the use of scientific ideas have resulted green revolution in India.

IV- A World View Perspective :

The Industrial Revolution was based upon the use of fossil fuels to run machines, very importantly, these very fossil fuels were also basic to the industrialization of society. Along with the perception of unlimited resources there was apparently unlimited environment for waste disposal. With these perceptions, and the advances and technology the economy prospered. But now we realize that resources and environment are finite. Currently two problems, resource depletion and environmental degradation are very closely related to science and technology. However, it is worth directing our attention to these problems, their solution and renewed efforts to rehabilitate environment and minimise the use of resources. Capra (1982) has observed that division between mind and matter led to a view of the universe as a mechanical system consisting of separate objects which in turn were reduced to fundamental building blocks where properties and interactions were thought to completely determine all natural phenomena. This Cartessan view of nature was further extended to living organisms which were regarded as machines constructed from separate parts'.

This whole process is inter related and inter dependent. Too much of fragmentation has created problems of personal health, degradation of social values and destruction of the environment. It needs a new perspective, which is holistic and organic in nature. Because there is an interplay into individuals and their natural and social environment, the balancing of this depends on a holistic view and it needs ecological

awareness and makes it obvious that we have to conserve our physical resources and develop our human resources (Capra, 1982). With this context it is apparent that people need an understanding of the 'dynamic world view' which is rapidly changing from mechanistic to holistic one. People should understand, internalize and practice this world view perspective which is a powerful dimension of scientific thinking. Examples of the items, in this dimension, are as follows :

27. Contributions of science and medicine have reduced child birth rate.

29. Science cannot give clean and healthy global environment.

Validity of Scientific Temper Scale

The most important consideration in judging the adequacy of a test is its validity. Instrument reliability is necessary, but not a sufficient condition for instrument validity. Being reliable is a part of being valid or to measure something consistently is to be measuring something. An instrument is valid if it measures what it is being used to measure. Thus, there are potentially as many types of validity as there are measurement purposes to which and instrument can be applied (Munnally, 1967).

Two major classes of instrument validity are identified.

1. Content validity
2. Construct validity

Content validity is concerned with the representativeness of

an instruments' subject matter. It is a matter of judgement. Such item in an instrument must be studied and its relevance to the measuring goals are to be evaluated. This procedure is most efficiently accomplished during instrument development. (Cronbach 1970, Kerlinger 1973, Munnally 1967). It is not possible to draw all items for the factors being assessed so a random sample of items from the content was selected. The content validity of scientific temper scale was judged during instrument development. The instrument is based on definitions of scientific temper. In addition to this the content validity of each item was also calculated by Lawshe (1975) method and the item having CVR below 0.62 were rejected.

Construct validity concerns the extent, to which a test tells us something about a meaningful characteristics of the individual. Testing the construct validity of an instrument is testing the theory behind the instrument. The instrument's ability to differentiate between the two groups can be evidenced of its construct validity. An instrument can be relevant to establishing its construct validity if the test items are expected to inter correlates i. e. finding (substantial) correlations between the test scores to the total scores. The instrument would than have predictive power in those situations which are defined by its items (Cronbach and Meehl 1966). The same procedure was adopted to calculate the construct validity of the instrument.

Inter correlations between the four dimensions of scientific Temper and correlations of these dimensions to the total score of the

different groups of samples were calculated. These correlations are shown in table 3.4.

TABLE 3.4

COEFFICIENT OF CORRELATION BETWEEN SCORES ON DIMENSIONS AND TOTAL SCORES ON SCIENTIFIC TEMPER SCALE (N=120)

Dimensions	Total Score	Aversion to super stition II	A set of Attitude III	A world view Perspective IV
I. Value Perspective	0.941	0.146	0.140	0.282
II. Aversion to superstitions	0.649		0.392	0.262
III. A set of Attitude	0.481			0.079
IV. A world view Perspective	0.563			

From the above it is evident that all the four dimensions of scientific temper scale are highly and positively correlated with the total scores of scale in the group of students. These high correlation between each dimension to the total score justified the inclusion of respective dimension in the scale. The table reflects the coefficient of correlation between each dimensions. All the calculated inter correlation coefficient are positive and weak. Hence each dimension has independent existence in the scientific temper scale, yielding high construct validity of the scale.

TABLE 3.5

RELIABILITY COEFFICIENTS OF DIMENSIONS OF SCIENTIFIC TEMPER SCALE

Dimensions	Reliability Coefficients
Total scale	0.838
I- Value perspective	0.758
II- Aversion to superstition	0.818
III- A set Attitude	0.562
IV- A world view perspective	0.544

The above table has revealed that the reliability coefficient of scientific temper scale found to be 0.838. The reliability coefficient of value perspective dimension is 0.758 and aversion to superstitions dimensions is 0.818. The coefficient of reliability for dimension attitude towards science is 0.562 and world view pespective dimension is 0.544. Thus, the reliability coefficient of total scale and dimensions of scientific temper are high yielding high reliability of the scale.

Final Form of Scientific Temper Scale :

The final form of scientific temper scale consisted of 30 items, measuring sample's Scientific Temper on four dimensions. The following table 3.6 shows the distribution of items and their polarity on different dimensions of scientific temper scale.

TABLE 3.6

DISTRIBUTION OF ITEMS IN EACH DIMENSION AND THEIR POLARITY

Dimensions	No. of Items	Positive Polarity Items No.	Negative Polarity Item No.
I. Value Perspective	16	1,2,3,5,6,8,10 12,13,15,17	4,7,9,14,16
II. Aversion the Superstitions	06		11,18,19,20,21,22
III. A set of Attitudes	04	24,25	23,26
IV. World View Perspective	04	27,28	29,30

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CHAPTER IV

PERFORMANCE ON THE UNDERSTANDING OF SCIENCE SCALE

4.1 Introduction :

The importance of science and technology in the modern world is increasingly growing to focus attention of the educators to decide the purposes, processes and assessment of science education programmes. Concern about the 'public understanding of science', the extent to which the public at large is aware and appreciates the implications of scientific and technological matters, need assessment from time to time. The Royal Society report on the Public Understanding of Science (Royal Society 1985), has mentioned that the previous surveys were concerned mainly with the attitudes of the public to science and had not provided evidence on how much science the Public knew. In this continuation Lucas (1988) has attempted to obtain some data about the knowledge of simple scientific ideas held by the General public.

The questions of developing understanding of science emerge from this context and a necessity of developing it in this part of the century. Hence, we think about what scientific and technological knowledge people use/need in daily life ? Second, how much of scientific knowledge students remember while attaining adulthood ? Here the first

question provides guide lines for science curriculum, science programme both formal and non formal and their relationship with socio-scientific and socio-cultural context.

The investigator contends that ethos of science is the ethos of contemporary society. Therefore science for all should include concepts of science, attitude towards science and science and technology related issues as well as scientific values. Educators assume that a deeper understanding of the concepts of science, and awareness about the complexity of science, technology political and economic positions, ethics and values leads directly to thoughtful decisions on social issues related to science. One of the fundamental aspects of education for scientific and technological literacy is the practice, use of knowledge, skill and understanding that will help citizens in personal matters, in civic concerns, in cultural perspective and in decision making. Understanding of science is directed towards knowledge and attitudes about science and technology in society.

The right to know is like the right to life' wrote Bernard Shaw. 'It is fundamental and unconditional in its assumption that knowledge like life is a desirable thing.' The holocast at Bhopal in 1984 has never like before, demonstrated the indispensibility of information for survival. The tragic death of over 2000 people in Bhopal shows that how vacuous the right to life can be without the right to information. In this case, the non availability of relevant and timely information stands out as single causative factor (Nanda, 1985).

Unfortunately, the researcher has failed to locate any published study in India on the understanding of science. Therefore, researcher has undertaken this humble attempt to determine the present position with consequences to science curriculum, teaching and assessment.

4.2 Analysis of the Responses of the Total Sample

The investigator has administered the understanding of science scale to a total sample of 1000 and tried to determine the level of understanding of total sample as a composite group. Table No. 4.1 has given the total score.

TABLE 4.1

MEAN AND S. D. OF TOTAL SAMPLE OF STUDENTS (N= 1000) ON UNDERSTANDING OF SCIENCE SCALE AND ITS DIMENSIONS

Understanding of Science Scale	Mean	S. D.
Total Score	55.28	7.48
Dimensions :		
I- Concept of Science	27.24	4.27
II- Science Policy	22.53	3.17
III- Value Judgement	5.47	1.62

Discussion :

The above table has revealed that the obtained mean of the total sample on the Understanding of Science Scale was 55.28 and S. D.

7.48 which is much higher than the theoretical mean 40 on this scale. Therefore, it is inferred that the total sample has favourable understanding of science. Hence, hypothesis No. 1 of the research stands rejected which states that the obtained mean and the theoretical mean are not different on the Understanding of Science Scale.

While discussing the obtained mean and the S. D. on three sub scales of the understanding of science scale it was found to be- Concept of Science 27.24 and 4.27, Science Policy 22.53 and 3.17 and Value Judgement 5.47 and 1.62 respectively. The findings has indicated that the sample has obtained higher mean than the theoretical mean on all the three subscales (20, 15, 5). Therefore, the sample has favourable understanding on all the three sub scales independently, that is the total sample has adequate understanding of science concepts, they react favourably on science policy dimension and react favourable on value judgement dimension.

4.3 Analysis of Responses of the Total Sample of Hindu and Muslim Independently

The investigator has determined the levels of understanding of science of the samples from Hindu and Muslim independently. He has also tried to find the responses on the different dimensions of the scale.

TABLE 4.2

MEAN, S. D. AND CRITICAL RATIO OF HINDU AND MUSLIM STUDENTS ON UNDERSTANDING OF SCIENCE SCALE AND ITS DIMENSIONS

Understanding of Science Scale	Hindu (N=600) Mean	S. D.	Muslim (N=400) Mean	S. D.	Critical Ratio	
Total Score	55.66	5.38	52.23	7.26	8.12	< .01
Dimensions :						
I- Science concepts	26.57	2.32	26.32	3.28	1.32	>.05
II-Science Policy	23.74	2.10	21.44	3.11	12.78	<.01
III- Value Judgement	5.43	1.31	4.78	1.47	7.22	< 0.1

Discussion :

The above table has indicated that the students from Hindu (N = 600) have obtained mean 55.64 and S. D. 5.38 on the understanding of science scale. Similarly, students from Muslim (N = 400) have obtained mean 52.23 and S. D. 7.26 respectively. Both of these means are higher than the theoretical mean indicating that both the groups from Hindu and Muslim possess favourable understanding of science.

While using critical ratio to determine the difference between these two groups, critical ratio was found to be 8.12 which is significant at 0.01 level, that is there is significant difference between two groups. The students of Hindu possess significantly higher understanding of science than the students of Muslim. Therefore, hypothesis No. 2 of present research was failed to be retained which states that 'There is no

significant difference between students of Hindu and students of Muslim on understanding of science.

Dimension I - Concepts of Science :

The above table has indicated that the obtained mean and S. D. of students from Hindu and Muslim was found to be 26.57 and 2.32 and 26.32 and 3.28 respectively. While applying critical ratio to determine the difference between two groups the critical ratio was 1.32 which is not significant at .05 level. Therefore, it is evident that there is no significant difference between understanding of concepts of science of Hindu and Muslim students.

Dimension II- Science Policy :

The above table has indicated that the students from Hindu have obtained mean 23.74 and S. D. 2.10 on dimension II. Similarly students from Muslim have obtained mean 21.44 and S. D. 3.11 on dimension II science policy. While applying critical ratio the value was 12.78 which is significant at .01and clearly indicate that Hindu students have much higher understanding of science policy than Muslim students.

Dimension III- Value Judgement :

The above table has indicated that the Hindu students have obtained mean 5.43 and S. D. 1.31 on dimension III. Similarly, Muslim students have obtained mean 4.78 and S. D. 1.47 respectively. While determining the difference between two groups by using critical ratio

the value was 7.22 which is significant at .01 level. It is inferred that the Hindu students possess higher value judgement on the understanding of science scale than the Muslim students.

4.4 Analysis of Responses of the Total Sample From Class 9th and Class 10th to Determine Their Understanding of Science

TABLE 4.3

MEAN, S. D. AND CRITICAL RATIO OF 9TH AND 10TH CLASS STUDENTS ON UNDERSTANDING OF SCIENCE AND ITS DIMENSIONS

Understanding of Science Scale	9th Class Students (N=660) Mean	S. D.	10th Class Students (N=340) Mean	S. D.	Critical Ratio	
Total Score	54.97	7.52	55.98	7.67	1.98	<.05
Dimensions						
I- Science concepts	26.72	4.22	27.71	3.95	3.67	<.01
II-Science Policy	22.95	3.98	23.13	3.31	0.75	>.05
III- Value Judgement	5.62	1.62	5.43	1.61	1.73	> 0.5

Discussion :

The above table has indicated that 9th class students (N=660) have obtained mean 54.97 and S. D. 7.52 on understanding of science scale. Similarly, 10th class students (N=340) have obtained mean 55.98 and S. D. 7.67 respectively. Both of these means are higher than the theoretical means indicating that both the 9th and 10th calss students possess favourable understanding of science.

While using critical ratio to determine the difference between these two groups the value was found to be 1.98 which is significant at .05 level. Hence, difference in two groups is significant and the hypothesis No. 3 of persent research, that is, there is no effect of class level of students on understanding of science has been rejected.

Dimension I- concepts of science :

The above table has indicated that the obtained mean and S. D. of 9th calss students and 10th class student were found to be 26.72 and 4.22 and 27.71 and 3.95 respectively. While applying critical ratio to determine the difference between two groups the value was 3.67 which is significant at .01 level. This difference has indicated that there is significant difference between two groups of students and 10th class students possess much more favourable understanding on dimension I, concepts of science.

Dimension II- Science Policy :

The above table has indicated that the obtained mean and S. D. of 9th class students and 10th class students were found to be 22.95 and 3.98 and 23.13 and 3.31 respectively. While applying critical ratio to determine the difference between the twc groups the value was 0.75 which is less than that value 1.96 and this not significant at .05 level. This difference has indicated that there is no significant difference between the two groups of students on Dimension II - Science Policy.

Dimension III- Value Judgement :

The above table has indicated that the obtained mean and S. D. of 9th class students and 10th class students were found to be 5.62 and 1.62 and 5.43 and 1.61 respectively. While applying critical ratio to determine the difference between two groups the value was 1.73 which is less than the value 1.96. This difference has indicated that there is no significant difference between the two groups of students on understanding of science of Dimension III- 'Value Judgement.

4.5 Analysis of Responses of the Male and Female Students to Determine Their Understanding of Science

TABLE 4.4

MEAN, S. D. AND CRITICAL RATIO OF MALE STUDENTS AND FEMALE STUDENTS ON UNDERSTANDING OF SCIENCE AND ITS DIMENSIONS

Understanding of Science Scale	Male Students (N=650)		Female Students (N=350)		Critical Ratio	
	Mean	S. D.	Mean	S. D.		
Total Score	55.95	7.13	55.63	8.11	0.62	<.05
Dimensions :						
I- Science concepts	27.75	4.14	27.62	4.14	0.48	>.05
II-Science Policy	23.35	3.47	22.84	3.53	2.60	<.01
III- Value Judgement	5.75	1.73	5.50	1.51	2.27	< .05

Discussion :

The above table has indicated that male students (N=650) have obtained mean 55.95 and S. D. 7.13 and female students (N=350) have obtained mean 55.63 and S. D. 8.11 on understanding of science scale. Both of these mean are higher than the theoretical means indicating that both the male and female students possess favourable understanding of science.

While using critical ratio to determine the difference between these two groups the value was found to be 0.62 which is less than the value 1.96, hence not significant at .05.

Thus, there is no significant difference between male students and female students on understanding of science scores. Therfore, the hypothesis No. 5 of present research has been retained.

Dimension I- Concepts of Science :

The above table has indicated that the obtained mean and S. D. of male students and female students were found to be 27.75 and 4.14 and 27.62 and 4.14 respectively. While applying critical ratio to determine the difference between two groups the value was 0.48 which is less than 1.96. Thus difference has indicated that there is no significant difference between male students and female students on dimension I- concepts of science of Understanding of Science Scale.

Dimension II- Science Policy :

The above table has indicated that the obtained mean and

S.D. of male students and female students were found to be 23.35 and 3.47 and 22.84 and 3.53 respectively. While applying critical ratio to determine the difference between the two groups the value was found to be 2.60 which is significant at .01 level. This difference has indicated that there is significant difference between the male students and female studnets on dimension II - Science Policy of the understanding of Science Scale. The male students possess more understanding of science on science policy than female students.

Dimension III- Value Judgement :

The above table has indicated that the obtained mean and S.D. of male students and female students were found to be 5.75 and 1.73 and 5.50 and 1.51 respectively. While applying critical ratio to determine the difference between two groups the value was found to be 2.27 which is significant at .05 level. This difference has indicated that there is significant difference between the male and female students on dimension III : 'Value Judgement on understanding of science scale. The male students have more understanding of science Value Judgement than female students.

4.6 Analysis of Responses of the Students from Schools Situated in Urban and Rural Areas to Determine Their Understanding of Science

TABLE 4.5

MEAN, S. D. AND CRITICAL RATIO OF TOTAL SAMPLE OF RURAL AND URBAN STUDENTS ON UNDERSTANDING OF SCIENCE AND ITS DIMENSIONS

Understanding of Science Scale	Rural Students (N=200)		Urban Students (N=800)		Critical Ratio	
	Mean	S. D.	Mean	S. D.		
Total Score	50.91	6.78	56.73	6.95	10.78	< .01
Dimensions :						
I- Science concepts	25.75	3.65	27.52	3.75	6.10	<.01
II-Science Policy	20.49	3.74	22.73	3.25	7.72	<.01
III- Value Judgement	4.95	1.73	5.75	1.47	6.15	< .01

Discussion :

The above table has indicate that rural students (N=200) have obtained mean 50.91 and S. D. 6.78 and urban students (N = 800) have obtained mean 56.73 and S. D. 6.95 respectively.

Both the means are higher than the theoretical means indicating that both the groups from rural and urban areas possess favourable understanding of science.

While calculating critical ratio to determine the difference between these two groups the value was found to be 10.78 which is

higher than the critical value at .01 and .05 level of significance. Thus, the total sample of urban students have significantly higher mean score on understanding of science than the total sample of rural students. Therefore, the hypothesis No. 5 of present research failed to be retained in respect to above significant difference.

Dimension I- Concepts of Science :

The above table has indicated that the obtained mean and S. D. of rural students and urban students were found to be 25.75 and 3.65 and 27.52 and 3.75 respectively. While calculating critical ratio to determine the difference between these two groups the value was found to be 6.10 which is significant at .01level. This difference has indicated that there is significant difference between two groups of students. Urban students possess much more favourable understanding on Dimension I that is, concepts of Science.

Dimension II- Science Policy :

The above table has indicated that the obtained mean and S. D. of rural students and urban students were found to be 20.49 and 3.74 and 22.73 and 3.25 respectively. While using critical ratio to determine the difference between the two groups the value was found to be 7.72 which is significant at .01 level. This difference has indicated that there is significant difference between two groups of students. Urban students possess much higher understanding in Dimension II that is Science Policy.

Dimension III- Value Judgement :

The above table has indicated that the obtained mean and S. D. of rural students and urban students were found to be 4.95 and 1.73 and 5.75 and 1.47 respectively. While using critical ratio to determine the difference between these two groups the value was found to be 6.15 which is significant at .01 level. This difference has indicated that there is significant difference between two groups of students. Urban students possess much higher understanding on Dimension III- that is, Value Judgement.

4.7 Analysis of Responses of the Students from Different types of Schools to Determine Their Understanding of Science

TABLE 4.6

MEAN, S.D. AND CRITICAL RATIO OF TOTAL SAMPLE OF STUDENTS FROM GOVERNMENT SCHOOLS AND PRIVATE SCHOOLS ON UNDERSTANDING OF SCIENCE AND ITS DIMENSIONS

Understanding of Science Scale	Govenrment School Students (N=750)		Private School Students (N=250)		Critical Ratio	
	Mean	S. D.	Mean	S. D.		
Total Score	54.35	6.97	57.94	5.13	8.76	<.01
Dimensions :						
I- Science concepts	26.47	3.45	29.42	2.78	13.41	<.01
II-Science Policy	21.71	2.98	24.61	2.98	13.18	<.01
III- Value Judgement	5.12	1.63	5.67	1.58	4.74	< .01

Discussion :

The above table has indicate that the students from Government schools (N=750) and the students from Private schools (N=250) have obtained mean 54.35 and 6.97 and 57.94 and 5.13 respectively. Both the means are higher than the theoretical means indicating that both the groups of students from Government school and Private schools possess favourable understanding of science.

While using critical ratio to determine the significance difference between these two means the value was found to be 8.76 which is significant at .01 level. Hence the students of private schools have got significantly higher mean scores than the students of government schools. Therefore, the hypothesis No. 6 of present research work stands rejected.

Dimension I- Concepts of Science :

The above table has indicated that the obtained mean and S. D. of students from Government and Private schools were found to be 26.47 and 3.45 and 29.42 and 2.78 respectively. While using critical ratio to determine the difference between these two groups the value was found to be 13.41, which is significant at .01level. This indicate that there is significant difference between two groups of students. Students from private schools possess much higher understanding in Dimension I, that is, Concepts of Science.

Dimension II- Science Policy :

The above table has indicated that the obtained mean and S. D. of students from Government and private schools were found to be 21.71 and 2.98 and 24.61 and 2.98 respectively. While using critical ratio to determine the difference between these two groups the value was found to be 13.18 which is significant at .01 level. This indicate that there is significant difference between two groups of students. Students from private schools possess much higher understanding on Dimension II-Science Policy.

Dimension III- Value Judgement :

The above table has indicated that the obtained mean and S. D. of students from Government and private schools were found to be 5.12 and 1.63 and 5.67 and 1.58 respectively. While using the critical ratio to determine the difference between these two groups the value was found to be 4.74 which is significant at .01 level. This indicate that there is significant difference between two groups of students. Students from private schools possess much higher understanding on Dimension III-Value Judgement.

4.8 Responses of Hindu Students from different types of Schools on Understanding of Science

TABLE 4.7

MEAN, S. D. AND CRITICAL RATIO OF HINDU STUDENTS FROM DIFFERENT TYPES OF SCHOOLS ON UNDERSTANDING OF SCIENCE SCALE AND ITS DIMENSIONS

Understanding of Science Scale	Govenrment Schools Students Hindu (N=400)		Private Schools Students Hindu (N=200)		Critical Ratio	
	Mean	S. D.	Mean	S. D.		
Total Score	54.21	6.27	58.65	4.13	10.32	< .01
Dimensions :						
I- Science concepts	26.32	3.46	29.41	3.32	10.66	<.01
II-Science Policy	22.48	3.13	25.10	2.15	11.91	<.01
III- Value Judgement	5.27	1.56	5.35	1.39	0.64	> .05

Discussion :

The above table has indicate that the Hindu students from Government schools (N=400) and Private schools (N = 200) have obtained mean and S. D. 54.21 and 6.27 and 58.65 and 4.13 respectively. Both the means are higher than the theoretical means indicating that both the students from Government schools and Private schools possess favourable understanding of science.

While using critical ratio to determine the difference between these two groups the value was found to be 10.32 which is higher than

2.58. This difference has indicated that there is significant difference at .01 level between the students from Government schools and the students from Private schools. Students from Private schools possess much more favorable understanding of science.

Dimension I- Concepts of Science :

The above table has indicated that the obtained mean and S.D. of Hindu students from Government schools and Private schools were to be found 26.32 and 3.46 and 29.41 and 3.32 respectively. While using critical ratio to determine the difference between these two groups the value was found to 11.99 which is significant at .01 level. This indicate that there is significant difference between two groups of students. The students from private schools possess much more favourable understanding in Dimension I, that is, Concepts of Science.

Dimension II- Science Policy :

The above table has indicated that the obtained mean and S.D. of Hindu students from Government schools and private schools were to be found 22.48 and 3.13 and 25.10 and 2.15 respectively. While using critical ratio to determine the difference between these two groups the value was found to be 11.91 which is significant at .01. This indicate that there is significant difference between two groups of students. Private schools students possess much higher understanding in Dimension II- that is, Science Policy.

Dimension III- Value Judgement :

The above table has indicated that the obtained mean and S. D. of Hindu students from Government schools and Private schools were found to be 5.27 and 1.56 and 5.35 and 1.39 respectively. While using critical ratio to determine the difference between these two groups the value was found to be 0.64 which is less than the value 1.96. This difference indicate that there is no significant difference between two groups of students.

4.9 Responses of Muslim Students from different types of Schools on Understanding of Science

TABLE 4.8

MEAN, S. D. AND CRITICAL RATIO OF MUSLIM STUDENTS FROM DIFFERENT TYPES OF SCHOOLS ON UNDERSTANDING OF SCIENCE SCALE AND ITS DIMENSIONS

Understanding of Science Scale	Govenrment Schools Students Muslim (N=350)		Private Schools Students Muslim (N=50)		Critical Ratio	
	Mean	S. D.	Mean	S. D.		
Total Score	53.17	7.94	54.96	8.95	1.34	> .05
Dimensions :						
I- Science concepts	26.54	4.28	28.23	4.36	2.56	<.05
II-Science Policy	21.21	3.91	21.35	4.13	0.23	>.05
III- Value Judgement	5.42	1.62	5.97	1.55	2.39	< .05

Discussion :

The above table has indicate that the Muslim students from Government schools (N=350) and Private schools (N = 50) have obtained mean and S. D. 53.17 and 7.94 and 54.96 and 8.95 respectively. Both the means are higher than the theoretical means indicating that both the groups from Government school and Private schools possess favourable understanding of science.

While using critical ratio to determine the difference between these two groups the value was found to be 1.34 which is less than 1.96. This difference has indicated that there is no significant difference difference between the Muslim students of Government schools and Private schools on understanding of science.

Dimension I- Concepts of Science :

The above table has indicated that the obtained mean and S.D. of Muslim students from Government schools and Private schools were to be found 26.54 and 4.28 and 28.23 and 4.36 respectively. While using critical ratio to determine the difference between these two groups the value was found to be 2.56 which is more than the critical value 1.96. This difference has indicated that there is significant difference between the Muslim students of Government schools and the students of Private schools on understanding of science on Dimension I that is, Concepts of Science.

Dimension II- Science Policy :

The above table has indicated that the obtained mean and S. D. of Muslim students from Government schools and Private schools were found to be 21.21 and 3.91 and 21.35 and 4.13 respectively. While using critical ratio to determine the difference between these two groups the value was found to be 0.23 which is less than the critical value 1.96. This difference has indicated that there is no significant difference between the Muslim students of Government schools and Private schools on understanding of Science on Dimension II : that is Science Policy.

Dimension III- Value Judgement :

The above table has indicated that the obtained mean and S.D. of Muslim students from Government schools and Private schools were found to be 5.42 and 1.62 and 5.97 and 1.55 respectively. While using critical ratio to determine the difference between these two groups the value was found to be 2.39 which is significant at .05 level. This indicate that there is significant difference between the Muslim students of Government schools and Private Schools on understanding of Science on Dimension III: that is Value Judgement.

4.10 Responses of Hindu students of 9th and 10th class on their Understanding of Science

TABLE 4.9

MEAN, S. D. AND CRITICAL RATIO OF 9TH AND 10TH CLASS HINDU STUDENTS ON UNDERSTANDING OF SCIENCE SCALE AND ITS DIMENSIONS

Understanding of Science Scale	9th class Students Hindu (N=410) Mean	S. D.	10th class Students Hindu (N=190) Mean	S. D.	Critical Ratio	
Total Score	55.23	6.47	60.17	4.76	10.51	< .01
Dimensions :						
I- Science concepts	27.13	3.32	29.32	3.13	7.82	<.01
II-Science Policy	23.43	3.03	24.21	2.47	3.39	<.01
III- Value Judgement	5.31	1.53	5.48	1.36	1.42	> .05

Discussion :

The above table has indicated that the 9th class and 10th class students of Hindu (N=410) and (N =190) respectively, have obtained mean and S. D. 55.23 and 6.47 and 60.17 and 4.76 respectively. Both the means are higher than the theoretical means indicating that both the groups from 9th and 10th class possess favourable understanding of science.

While using critical ratio to determine the difference between these two groups the value was found to be 10.51 which is significant at .01 level. This indicate that there is significant difference between the

9th class and 10th class students of Hindu. 10th class students possess much higher understanding of science.

Dimension I- Concepts of Science :

The above table has indicated that the obtained mean and S.D. of 9th and 10th class Hindu students were to be found 27.13 and 3.32 and 29.32 and 3.13 respectively. While using critical ratio to determine the difference between these two groups the value was found to be 7.82 which is higher than the critical value 2.58. This difference has indicated that there is significant difference between 9th and 10th class Hindu students. 10th class students possess much more favourable understanding of science in dimension I, that is Concepts of Science.

Dimension II- Science Policy :

The above table has indicated that the obtained mean and S.D. of 9th and 10th class Hindu students were found to be 23.43 and 3.03 and 24.21 and 2.47 respectively. While using critical ratio to determine the difference between these two groups the value was found to be 3.39 which is significant at .01 level. This indicated that there is significant difference between the 9th class students and 10th class students. 10th class students possess much higher understanding of science in Dimension II : that is Science Policy.

Dimension III- Value Judgement :

The above table has indicated that the obtained mean and

S. D. of Hindu students of 9th and 10th class were found to be 5.31 and 1.53 and 5.48 and 1.36 respectively. While using critical ratio to determine the difference between these two groups the value was found to be 1.42 which is lesser than the critical value 1.96. This difference indicated that there is no significant difference between the 9th class Hindu students and 10th class Hindu students.

4.11 Responses of Muslim students of 9th and 10th class on their Understanding of Science

TABLE 4.10

MEAN, S.D. AND CRITICAL RATIO OF 9TH AND10TH CLASS MUSLIM STUDENTS ON UNDERSTANDING OF SCIENCE SCALE AND ITS DIMENSIONS

Understanding of Science Scale	9th class Students Muslim (N=250) Mean	S. D.	10th class Students Muslim (N=150) Mean	S. D.	Critical Ratio	
Total Score	52.37	8.21	53.46	7.24	1.38	> .05
Dimensions :						
I- Science concepts	26.45	4.96	27.75	4.34	2.75	<.01
II-Science Policy	20.56	3.78	21.38	3.54	2.16	<.05
III- Value Judgement	5.75	1.38	4.43	1.32	9.43	< .01

Discussion :

The above table has indicated that the Muslim students of 9th class (N=250) and 10th class (N=150) have obtained mean and S. D.

52.37 and 8.21 and 53.46 and 7.24 respectively. Both of these means are higher than the theoretical means indicating that both 9th and 10th class Muslim students possess favourable understanding of science.

While using critical ratio to determine the difference between these two groups the value was found to be 1.38 which is less than the critical value 1.96. This difference has indicated that there is no significant difference between two groups of students on understanding of science.

Dimension I- Concepts of Science :

The above table has indicated that the obtained mean and S. D. of 9th and 10th class Muslim students are 26.45 and 4.96 and 27.75 and 4.34 respectively. While applying critical ratio to determine the difference between two groups the value was 2.76 which is more than 2.58, hence significant at .01 level. This difference has indicated that there is significant difference between two groups of students on understanding of science on Dimension I, that is the 10th class Muslim students have more understanding of concepts of science than 9th class Muslim students.

Dimension II- Science Policy :

The above table has indicated that the obtained mean and S. D. of 9th and 10th class Muslim students are 20.56 and 3.78 and 21.38 and 3.54 respectively. While applying critical ratio to determine the difference between two groups the value was 2.16 which is higher than 1.96 hence significant at .05 level. This difference has indicated

that 10th class students possess much higher understanding of science than the 9th class students, on Dimension II : Science Policy.

Dimension III- Value Judgement :

The above table has indicated that the obtained mean and S. D. of 9th and 10th class Muslim students were 5.75 and 1.38 and 4.43 and 1.32 respectively. While applying critical ratio to determine the difference between these two groups the value was found to be 9.43 which is more than 2.58, hence significant at .01 level. This difference has indicated that there is significant difference between two groups of students on dimension III-Value Judgement of the Understanding of Science Scale.

Contd.....

4.12 Responses of 9th class Students of Hindu and Muslim Concerning their Understanding of Science

TABLE 4.11

MEAN, S. D. AND CRITICAL RATIO OF 9TH CLASS STUDENTS OF HINDU AND MUSLIM ON UNDERSTANDING OF SCIENCE SCALE AND ITS DIMENSIONS

Understanding of Science Scale	9th class Hindu Students (N=410) Mean	S. D.	9th class Muslim Students (N=250) Mean	S. D.	Critical Ratio	
Total Score	55.71	5.47	52.28	8.34	5.81	< .01
Dimensions :						
I- Science concepts	27.50	3.13	26.37	4.67	3.42	<.01
II-Science Policy	23.64	2.47	20.54	3.65	11.92	<.01
III- Value Judgement	5.65	1.35	5.23	1.87	3.00	< .01

Discussion :

The above table has indicated that the 9th class Hindu students (N=410) and 9th class Muslim students (N =250) have obtained mean and 55.71 and S. D. 5.47 and 52.28 and S. D. 8.34 respectively. Both of these means are higher than the theoretical means indicating that both the 9th class students of Hindu and Muslim possess favourable understanding of science.

While applying critical ratio to determine the difference between these two groups the value was found to be 5.81 which is higher than the critical value 2.58 at .01 level. This difference has indicated that

there is significant difference between two groups of students. 9th class students of Hindu possess much more favourable understanding of science than their 9th class Muslim counterparts.

Dimension I- Concepts of Science :

The above table has indicated that the 9th class students of Hindu and the 9th class students of Muslim have obtained mean and S. D. of 27.50 and 3.13 and 26.37 and 4.67 respectively. Applying critical ratio to determine the difference between two groups the value was 3.42 which is more than 2.58, hence significant at .01 level. This difference has indicated that there is significant difference between 9th class students of Hindu and the 9th class students of Muslim in understanding science on Dimension I- concepts of science of understanding of science scale.

Dimension II- Science Policy :

The above table has indicated that the 9th class students of Hindu and the 9th class students of Muslim have obtained mean and S. D. of 23.64 and 2.47 and 20.54 and 3.65 respectively. Applying critical ratio to determine the difference between two groups the CR value was found to be 11.92 which is higher than the value 2.58, hence significant at .01 level. This difference has indicated that there is significant difference between two groups of students. 9th class students of Hindu possess much more higher understanding of science in Dimension II : Science Policy of Understanding Science Scale, than their 9th class Muslim counterparts.

Dimension III- Value Judgement :

The table indicated that the 9th class students of Hindu and 9th class students of Muslim have obtained mean and S. D. of 5.65 and 1.35 and 5.23 and 1.87 respectively. Applying critical ratio to determine the difference between two groups the 'CR' value was 3.00 which is higher than 2.58, hence significant at .01 level. This difference has indicated that there is significant difference between two groups of students. 9th class students of Hindu possess much higher understanding of science in Dimension III-Value Judgement of Understanding of Science Scale.

4.13 Responses of 10th class students of Hindu and Muslim Concerning their Understanding of Science

TABLE 4.12

MEAN, S. D. AND CRITICAL RATIO OF 10TH CLASS STUDENTS OF HINDU AND MUSLIM ON UNDERSTANDING OF SCIENCE SCALE AND ITS DIMENSIONS

Understanding of Science Scale	10th class Hindu Students (N = 190)		10th class Muslim Students (N =150)		Critical Ratio	
	Mean	S. D.	Mean	S. D.		
Total Score	60.07	4.49	54.57	6.78	8.59	< .01
Dimensions :						
I- Science concepts	29.46	2.97	27.61	3.46	5.14	<.01
II-Science Policy	24.55	2.39	21.53	2.87	10.41	<.01
III- Value Judgement	5.78	1.34	5.27	1.51	3.19	< .01

Discussion :

The above table has indicated that the obtained mean and S. D. of the 10th class students of Hindu (N=190) and the 10th class students of Muslim have 60.07 and 4.49 and 54.57 and 6.78. Both of these means are higher than the theoretical means indicating that both the groups possess favourable understanding of science. Using critical ratio to determine the difference between these two groups 'CR' value was found to be 8.59 which is higher than the 2.58, hence significant at .01 level. This difference has indicated that there is significant difference between the 10th class students of Hindu and 10th class students of Muslim.

Dimension I- Concepts of Science :

The above table has indicated that the 10th class students of Hindu and the 10th class students of Muslim have obtained mean and S. D. of 29.46 and 2.97 and 27.61 and 3.46 respectively. Applying critical ratio to determine the difference between two groups the 'CR' value was found to be 5.14 which is higher than the critical value of 2.58, hence significant at .01 level. Thus there is significant difference between 10th class students of Hindu and 10th class students of Muslim in understanding science in Dimension I- Concepts of Science. 10th class students of Hindu possess much higher understanding of Science.

Dimension II- Science Policy :

The above table indicated that the obtained mean and S. D. of

10th class students of Hindu and 10th class students of Muslim were found to be 24.55 and 2.39 and 21.53 and 2.87 respectively. Applying critical ratio to determine the difference between these two groups of students the 'CR' value was found to be 10.41 which is higher than 2.58, hence significant at .01 level. This difference has indicated that there is significant difference between 10th class students of Hindu and 10th class students of Muslim. 10th class students of Hindu possess much more higher understanding of Science in Dimension II : Science Policy of Understanding Science Scale.

Dimension III- Value Judgement :

The above table has indicated that the obtained mean and S. D. of 10th class students of Hindu and 10th class students of Muslim were found to be 5.78 and 1.34 and 5.27 and 1.51 respectively. Applying critical ratio to determine the difference between two groups the 'CR' value was 3.19 which is higher than 2.58, hence significant at .01 level. This difference has indicated that there is significant difference between two groups of students. 10th class students of Hindu possess higher understanding of science in Dimension III-Value Judgement of Understanding of Science Scale.

4.14 Responses of Male and Female Students of Hindu Concerning their Understanding of Science

TABLE 4.13

MEAN, S. D. AND CRITICAL RATIO OF MALE STUDENTS AND FEMALE STUDENTS OF HINDU ON UNDERSTANDING OF SCIENCE AND ITS DIMENSIONS

Understanding of Science Scale	Male Hindu Students (N = 367)		Female Hindu students (N = 233)		Critical Ratio	
	Mean	S. D.	Mean	S. D.		
Total Score	56.13	6.17	56.52	6.87	0.71	>.05
Dimensions :						
I- Science concepts	27.21	3.07	27.45	3.69	0.83	>.05
II-Science Policy	23.79	2.90	24.41	2.30	2.95	<.01
III- Value Judgement	5.64	1.17	5.72	1.07	0.89	> .05

Discussion :

The above table has indicated that the Male Students (N=367) and the Female students (N=233) of Hindu have obtained mean and S.D. 56.13 and 6.17 and 56.52 and 6.87 respectively. Both of these means are higher than the theoretical mean, indicating that both male and female students possess favourable understanding of science.

While using critical ratio to determine the difference between these two groups, 'CR' value was found to be 0.71 which is less than the 1.96, hence not significant at .05 level. This difference has indicated that there is no significant difference between male students and female students on understanding of science.

Dimension I- Concepts of Science :

The above table has indicated that the obtained mean and S.D. of male and female students of Hindu have 27.21 and 3.07 and 27.45 and 3.69 respectively. Applying critical ratio to determine the difference between male and female students the value was found to be 0.83 which is less than 1.96.This difference has indicated that there is no significant difference between male and female students on understanding of science in Dimension I- Concepts of Science on understanding of Science Scale.

Dimension II- Science Policy :

The above table has indicated that the obtained mean and S. D. of male and female students of Hindu have 23.79 and 2.90 and 24.41 and 2.30 respectively. Applying critical ratio to determine the difference between male and female students the value was found to be 2.95 which is higher than 2.58, hence significant at .01 level. This difference has indicated that there is significant difference between male and female studnets. Female students of Hindu possess much higher understanding of science in Dimension II- Science Policy of understanding of Science Scale.

Dimension III- Value Judgement :

The above table has indicated that the obtained mean and S. D. of male students and female students were found to be 5.64 and 1.17 and 5.72 and 1.07. Applying critical ratio to determine the difference

between two groups the 'CR' value was found to be 0.89 which is less than the value 1.96. This difference has indicated that there is no significant difference between male and female students on understanding of science on Dimension III : 'Value Judgement' of Understanding of science scale.

4.15 Responses of Male and Female Students of Muslim on Understanding of Science

TABLE 4.14

MEAN, S.D. AND CRITICAL RATIO OF MALE STUDENTS AND FEMALE STUDENTS OF MUSLIM ON UNDERSTANDING OF SCIENCE AND ITS DIMENSIONS

Understanding of Science Scale	Male Muslim Students (N =233)		Female Muslim students (N =167)		Critical Ratio	
	Mean	S. D.	Mean	S. D.		
Total Score	53.23	7.97	52.42	7.99	1.00	>.05
Dimensions :						
I- Science concepts	27.53	4.18	26.84	4.11	1.64	>.05
II-Science Policy	21.43	3.91	20.57	3.98	2.15	<.05
III- Value Judgement	5.91	1.18	4.87	1.05	9.30	< .01

Discussion :

The above table has indicated that the male students (N=233) and the female students (N=167) of Muslim have obtained mean 53.23 and 7.97 and 52.42 and 7.99 respectively. Both of these means are

higher than the theoretical mean indicating that both male and female students possess favourable understanding of science. Applying critical ratio between these two groups, 'CR' value was found to be 1.00 which is less than the value1.96. This difference has indicated that there is no significant difference between male and female students of Muslim.

Dimension I- Concepts of Science :

The above table has indicated that the obtained mean and S. D. of male and female students were found to be 27.53 and 4.18 and 26.84 and 4.11 respectively. Applying the critical ratio between two groups the 'CR' value was found to be 1.64, which is less than 1.96, hence not significant at .05 level. This difference has indicated that there is no significant difference between male students and female students on understanding of science in Dimension I- Concepts of Science.

Dimension II- Science Policy :

The above table has indicated that the obtained mean and S. D. of male and female students of Muslim were found to be 21.43 and 3.91 and 20.57 and 3.98 respectively. Applying critical ratio to determine the difference between male and female students the 'CR' value was found to be 2.15 which is more than 1.96, hence significant at .05 level. This difference has indicated that there is significant difference between male and female studnets. The male students possess higher understanding of science in Dimension II- Science Policy of Understanding Science.

Dimension III- Value Judgement :

The table indicated that the obtained mean and S. D. of male students and the female students have found to be 5.91 and 1.18 and 4.87 and 1.05 respectively. Applying critical ratio between the two groups 'CR' value was found to be 9.30 which is more than 2.58, hence significant at .01 level. This has indicated that there is significant difference between male and female students. The male students possess higher understanding of science in Dimension III : 'Value Judgement' of Understanding Science.

4.16 Responses of Male Students of Hindu and Muslim on Understanding of Science

TABLE 4.15

MEAN, S. D. AND CRITICAL RATIO OF MALE STUDENTS OF HINDU AND MALE STUDENTS OF MUSLIM ON UNDERSTANDING OF SCIENCE SCALE AND ITS DIMENSIONS

Understanding of Science Scale	Male Hindu Students (N = 367)		Male Muslim Students (N =233)		Critical Ratio	
	Mean	S. D.	Mean	S. D.		
Total Score	57.13	5.45	55.17	7.34	3.50	< .01
Dimensions :						
I- Science concepts	27.25	2.07	27.05	3.89	0.71	>.05
II-Science Policy	23.73	2.98	21.37	3.49	8.43	<.01
III- Value Judgement	6.34	1.54	5.91	1.62	3.31	< .01

Discussion :

The above table indicated that the male students of Hindu (N=367) and the male students of Muslim (N = 233) have obtained mean and S. D. 57.13 and 5.45 and 55.17 and 7.34 on understanding of science scale. Both of these means are higher than the theoretical means indicating that both the male students of Hindu as well as of Muslim possess favourable understanding of science. While using critical ratio to determine the difference between two groups 'CR' value was found to be 3.50 which is more than the value 2.58. This difference has indicated that there is significant difference at .01 level, between the male students. The male students of Hindu possess higher understanding of science.

Dimension I- Concepts of Science :

The above table has indicated that the obtained mean and S. D. of the male students of Hindu and Muslim were found to be 27.25 and 2.07 and 27.05 and 3.89 respectively. Applying critical ratio to determine the difference between two groups the 'CR' value was found to be 0.71 which is less than the value 1.96. This difference has indicated that there is no significant difference between the two groups of students on Dimension I- Concepts of Science on Understanding Science.

Dimension II- Science Policy :

The above table has indicated that the obtained mean and S. D. of the male students of Hindu and muslim were found to be 23.73 and 2.98 and 21.37 and 3.49 respectively. Applying critical ratio to

determine the difference between two groups the value was found to 8.43 which is higher than 2.58 probability level. This difference has indicated that there is significant difference at .01 between the male students of Hindu and Muslim. Male students of Hindu possess much higher understanding of science in dimension II : Science Policy of Understanding Science.

Dimension III- Value Judgement :

The above table indicated that the male students of Hindu and Muslim have obtained mean and S. D. 6.34 and 1.54 and 5.91 and 1.62 respectively. Applying critical ratio to determine the difference between two groups the 'CR' value was found to be 3.31 which is higher than 2.58, hence significant at .01 level. This difference has indicated that there is significant difference between the male students of Hindu and the female students of Muslim. The male students of Hindu possess much higher understanding of science in Dimension III-Value Judgement of Understanding of Science Scale.

Contd....

4.17 Responses of Female Students of Hindu and Muslim on Understanding of Science

TABLE 4.16

MEAN, S.D. AND CRITICAL RATIO OF FEMALE STUDENTS OF HINDU AND FEMALE STUDENTS OF MUSLIM ON UNDERSTANDING OF SCIENCE SCALE AND ITS DIMENSIONS

Understanding of Science Scale	Female Hindu Students (N = 233)		Female Muslim Students (N =167)		Critical Ratio	
	Mean	S. D.	Mean	S. D.		
Total Score	56.39	6.97	53.42	7.67	3.96	< .01
Dimensions :						
I- Science concepts	27.25	3.98	26.84	4.14	1.00	>.05
II-Science Policy	24.42	2.46	20.57	3.34	12.83	<.01
III- Value Judgement	5.54	1.48	5.17	1.96	2.05	< .05

Discussion :

The above table indicated that the female students of Hindu and the female students of Muslim have obtained mean 56.39 and S. D. 6.97 and mean 53.42 and S. D. 7.67 respectively. Both of these means are higher than the theoretical mean indicating that both the female students of Hindu as well as of Muslim possess favourable understanding of science. While using critical ratio to determine the difference between two groups, 'CR' value was found to be 3.96 which is higher than 2.58, hence significant at .01 level. This indicated that there is significant

difference between female students of Hindu and Muslim. Female students of Hindu possess higher understanding of science.

Dimension I- Concepts of Science :

The table has indicated that the obtained mean and S. D. of the female students of Hindu and Muslim were found to be 27.25 and 3.98 and 26.84 and 4.14 respectively. While using critical ratio to determine the difference between two groups the 'CR' value was 1.00 which is less than 1.96 at 0.5 significance level. This difference has indicated that there is no significant difference between the female students of Hindu and Muslim on understanding of science in Dimension I- Concepts of Science of Understanding Science Scale.

Dimension II- Science Policy :

The table indicated that the obtained mean and S. D. of female students of Hindu and Muslim were found to be 24.42 and 2.46 and 20.57 and 3.34 respectively. Using critical ratio to determine the difference between female students of two groups the 'CR' value was 12.83 which is significant at .01 level. This indicated that there is significant difference between the female students of Hindu and Muslim. Female students of Hindu possess much higher understanding of Science in Dimension II - Science Policy of Understanding Science Scale.

Dimension III- Value Judgement :

The table has indicated that the female students of Hindu and

the female students of Muslim have obtained mean and S. D. 5.54 and 1.48 and 5.17 and 1.96 respectively. Using critical ratio to determine the difference between these two groups the 'CR' value was found to be 2.05 which is higher than 1.96 at .05 significance level. This difference has indicated that there is significant difference between two groups of students. Female students of Hindu possess much higher understanding of science in Dimension III-Value Judgement of Understanding of Science Scale.

4.18 Responses of Rural and Urban Students of Hindu on Understanding of Science

TABLE 4.17

MEAN, S.D. AND CRITICAL RATIO OF RURAL STUDENTS AND URBAN STUDENTS OF HINDU ON UNDERSTANDING OF SCIENCE SCALE AND ITS DIMENSIONS

Understanding of Science Scale	Rural Hindu Students (N = 117)		Urban Hindu Students (N =483)		Critical Ratio	
	Mean	S. D.	Mean	S. D.		
Total Score	50.68	5.37	57.97	5.19	13.25	< .01
Dimensions :						
I- Science concepts	24.38	3.35	28.21	3.53	10.94	<.01
II-Science Policy	20.90	2.94	24.92	2.28	13.86	<.01
III- Value Judgement	5.77	1.37	5.93	1.26	1.14	> .05

Discussion :

The above table indicated that the rural students (N=117) and urban students (N=483) of Hindu have obtained mean 50.68 and 5.37 S. D. and mean 57.97 and S. D. 5.19 respectively. Both of these means are higher than the theoretical mean indicating that both the rural students and urban students of Hindu possess favourable understanding of science. Using critical ratio between these two groups, 'CR' value was found to be 13.25 which is significant at .01 level. This has indicated that there is significant difference between two groups of students. It shows that urban students of Hindu possess much higher understanding of science than the rural students.

Dimension I- Concepts of Science :

The table indicated that the mean and S. D. of the rural students and the urban students of Hindu were found to be 24.38 and 3.35 and 28.21 and 3.53 respectively. Using critical ratio to determine the difference between two groups the 'CR' value was to be 10.94 which is higher than 2.58 hence significant at .01 level. This difference indicates that there is significant difference between the rural students and the urban students. urban students of Hindu possess much higher understanding of Science in Dimension I-Concepts of Science of understanding science scale.

Dimension II- Science Policy :

The table indicated that the mean and S. D. of the rural

students and the urban students of Hindu were found to be 20.90 and 2.94 and 24.92 and 2.28 respectively. Using critical ratio to determine the difference between two groups the 'CR' value was found to be 13.86 which is significant at .01 level. This is quiet significant between the rural and the urban students of Hindu. Urban students of Hindu possess much higher understanding of science than the students of Hindu from rural areas on dimension II- Science Policy of understanding Science Scale.

Dimension III- Value Judgement :

The above table has indicated that the obtained mean and S. D. of rural students and urban students of Hindu were found to be 5.77 and 1.37 and 5.93 and 1.26 respectively. Using critical ratio to determine the difference between two groups the 'CR' value was 1.14 which is less than 1.96 at .05 significance level. This difference has indicated that there is no significant difference between two groups of students on understanding of Science in Dimension III-Value Judgement of Understanding Science Scale.

4.19 Responses of Rural and Urban Students of Muslim on Understanding of Science

TABLE 4.18

MEAN, S.D. AND CRITICAL RATIO OF RURAL STUDENTS AND URBAN STUDENTS OF MUSLIM ON UNDERSTANDING OF SCIENCE SCALE AND ITS DIMENSIONS

Understading of Science Scale	Rural Muslim Students (N = 117)		Urban Muslim Students (N =483)		Critical Ratio	
	Mean	S. D.	Mean	S. D.		
Total Score	51.46	8.34	53.93	8.46	2.40	< .05
Dimensions :						
I- Science concepts	25.53	4.18	27.31	4.35	3.42	<.01
II-Science Policy	20.64	3.39	21.42	3.92	1.81.	>.05
III- Value Judgement	5.16	1.71	5.93	1.37	3.85	> .01

Discussion :

The table indicated that the obtaind mean and S. D. of rural students and urban students of Muslim were found to be 51.46 and 8.34 and 53.94 and 8.46 respectively. Both of these means were found to be higher than the theoretical mean indicating that both the rural and urban students of Muslim possess favourable understanding of science. Using critical ratio to determine the difference between these two groups, the 'CR' value was found to be 2.40 which is higher than 1.96 at .05 significance level. This difference indicates that there is significant difference between the two groups of students. The students

from urban area possess much more favourable understanding of Science than the students from rural areas.

Dimension I- Concepts of Science :

The table indicated that the obtained mean and S. D. of rural students and urban students of Muslim were found to be 25.53 and 4.18 and 27.31 and 4.35 respectively. The critical ratio was found to be 3.42 which is higher than 2.58 at .01 significance level. This difference has indicated that there is significant difference between the two groups of students. The sudents from urban area possess much higher favourable understanding of science on Dimension I- Concepts of Science of understanding of science scale.

Dimension II- Science Policy :

The table indicated that the obtained mean and S. D. of rural students and urban students of Muslim were found to be 20.64 and 3.39 and 21.42 and 3.92 respectively. Using critical ratio to determine the difference between these two groups, the 'CR' value was found to be 1.81 which is less than 1.96 at .05 significance level. This difference indicates that there is no significant difference between the two groups of students on understanding of Science on Dimension II- Science Policy of Understanding Science Scale.

Dimension III- Value Judgement :

The table indicated that the obtained mean and S. D. of rural

students and urban students of Muslim were found to be 5.16 and 1.71 and 5.93 and 1.37 respectively. Using critical ratio to determine the difference between these two groups, the 'CR' value was found to be 3.85 which is more than 2.58 at .01 significance level. This difference indicates that there is significant difference between the two groups of students. The students from urban area possess much higher understanding of science on Dimension III-Value Judgement of Understanding Science.

4.20 Responses of Rural Students of Hindu and Muslim on Understanding of Science

TABLE 4.19

MEAN, S. D. AND CRITICAL RATIO OF RURAL STUDENTS OF HINDU AND RURAL STUDENTS OF MUSLIM ON UNDERSTANDING OF SCIENCE SCALE AND ITS DIMENSIONS

Understanding of Science Scale	Rural Hindu Students (N=117)		Rural Muslim Students (N=83)		Critical Ratio	
	Mean	S. D.	Mean	S. D.		
Total Score	53.68	6.37	53.24	7.45	0.43	< .05
Dimensions :						
I- Science concepts	25.38	2.93	25.85	3.63	0.98	>.05
II-Science Policy	21.09	3.15	20.34	3.27	1.63	>.05
III- Value Judgement	5.91	1.37	5.68	1.49	1.09	> .05

Discussion :

The table indicated that the rural students of Hindu (N=117) and the rural students of Muslim (N=83) have obtaind mean 53.68 and 6.37 and 53.24 and 7.45 respectively.

Both of these means are higher than the theoretical mean indicating that the rural students of Hindu and rural students of Muslim possess favourable understanding of science. Using critical ratio to determine the difference between these two groups 'CR' value was found to be 0.43 which is less than 1.96 at .05 significance level. This difference has indicated that there is no significant difference between the two groups of students on understanding of science.

Dimension I- Concepts of Science :

The table indicated that the obtained mean and S. D. of rural students of Hindu and rural students of Muslim were found to be 25.38 and 2.93 and 25.85 and 3.63 respectively. Using critical ratio to determine the difference between these two groups 'CR' value was found to be 0.98 which is less than value 1.96 at .05 significance level. This difference has indicated that there is no significant difference between the two groups of students of Hindu and Muslim on understanding of science on Dimension I- Concepts of Science of Understanding of Science Scale.

Dimension II- Science Policy :

The table indicated that the obtained mean and S. D. of rural students of Hindu and rural students of Muslim were found to be 21.09

and 3.15 and 20.34 and 3.27 respectively. Using critical ratio to determine the difference between these two groups 'CR' value was found to be 1.63 which is less than 1.96 at .05 significance level. This difference has indicated that there is no significant difference between the two groups of students of Hindu and Muslim on understanding of Science on Dimension II- Science Policy of Understanding Science Scale.

Dimension III- Value Judgement :

The table indicated that the obtained mean and S. D. of rural students of Hindu and Muslim were 5.91 and 1.37 and 5.68 and 1.49 respectively. Applying critical ratio to determine the difference between two groups, the 'CR' value was found to be 1.09 which is less than the value 1.96 at .05 significance level. This difference has indicated that there is no significant difference between the two groups of students on understanding science on Dimension III-Value Judgement of Understanding Science Scale.

Contd....

4.21 Responses of Urban Students of Hindu and Muslim on Understanding of Science

TABLE NO. 4.20

MEAN, S. D. AND CRITICAL RATIO OF URBAN STUDENTS OF HINDU AND URBAN STUDENTS OF MUSLIM ON UNDERSTANDING OF SCIENCE SCALE AND ITS DIMENSIONS

Understanding of Science Scale	Urban Hindu Students (N=483)		Urban Muslim Students (N=317)		Critical Ratio	
	Mean	S. D.	Mean	S. D.		
Total Score	58.27	5.16	54.93	6.85	7.42	< .01
Dimensions :						
I- Science concepts	28.34	2.97	27.31	3.97	3.96	<.01
II-Science Policy	24.92	2.26	21.95	3.94	12.37	<.01
III- Value Judgement	6.23	1.26	6.01	1.37	2.44	< .05

Discussion :

The table has indicated that the urban Hindu students and the urban Muslim students have obtaind mean and S. D. as 58.27 and 5.16 and 54.93 and 6.85 respectively. Both of these means are higher than the theoretical mean indicating that both the groups possess favourable understanding of science. Using critical ratio to determine the difference between groups the 'CR' value was found to be 7.42 which is higher than 2.58 at .01 significance level. This difference has indicated significant difference between two groups of students. Students from urban areas of Hindu possess much more favourable on understanding of science.

Dimension I- Concepts of Science :

The above table has indicated that the obtained mean and S.D. of urban students from Hindu and Muslim students were found to be 28 34 and 2.97 and 27.31 and 3.97 respectively. Using critical ratio to determine the difference between two groups 'CR' value was 3.96 which is higher than 2.58 at .01 significance level. This difference has indicated that there is significant difference between two groups of students. Hindu students from Urban area possess much more favourable understanding of science in Dimension I- Concepts of Science of Understanding of Science scale.

Dimension II- Science Policy :

The table indicated that the urban Hindu students and the urban Muslim students have their mean and S. D. as 24.92 and 2.26 and 21.95 and 3.94 respectively. Using critical ratio to determine the difference between two groups the 'CR' value was 12.37 which is higher than 2.58 at .01 significance level. This difference has indicated that there is significant difference between two groups of students. Hindu students from urban area possess much higher understanding of Science on dimension II- Science Policy of understanding of Science Scale.

Dimension III- Value Judgement :

The above table indicates that the urban students of Hindu and Muslim have their obtained mean and S. D. as 6.23 and 1.26 and 6.01 and 1.37 respectively. Applying critical ratio to determine the

difference between two groups, the 'CR' value was 2.44, which is higher than 1.96 at .05 significance level. This difference has indicated that there is significant difference between two groups of students. Students from urban areas of Hindu possess much higher understanding of science in Dimension III-Value Judgement of Understanding of Science Scale.

4.22 Responses of Students of Hindu and Muslim from Government Schools on Understanding of Science

TABLE 4.21

MEAN, S. D. AND CRITICAL RATIO OF STUDENTS OF HINDU AND MUSLIM FROM GOVERNMENT SCHOOLS ON UNDERSTANDING OF SCIENCE SCALE AND ITS DIMENSIONS

Understanding of Science Scale	Government School's Hindu Students (N=400)		Muslim Students (N=300)		Critical Ratio	
	Mean	S. D.	Mean	S. D.		
Total Score	56.31	6.68	53.97	7.35	4.33	< .01
Dimensions :						
I- Science concepts	26.12	3.57	26.45	4.17	1.10	>.05
II-Science Policy	22.71	3.38	21.98	3.78	2.61	<.01
III- Value Judgement	5.82	1.56	5.29	1.48	4.42	< .01

Discussion :

The above table has indicated that the Hindu students from Government schools (N=400) have obtaind mean 56.31 and S. D. 6.68. Similarly Muslim students from Government schools (N=300) have

obtained mean 53.97 and S. D. 7.35 respectively. Both these means are higher than the theoretical mean indicating that both the students group of Hindu and Muslim possess favourable understanding of science. Using critical ratio to determine the difference between these two groups, 'CR' value was found to be 4.33 which is higher than 2.58 at .01 significance level. This difference has indicated that there is significant difference between two groups of students. Hindu students of Government school possess much more favourable understanding of science than the Muslim students of Government schools.

Dimension I- Concepts of Science :

The above table indicated that the Hindu and Muslim students of Government schools have their obtained mean and S. D. as 26.12 and 3.57 and 26.45 and 4.17 respectively. Using critical ratio to determine the difference between two groups the 'CR' value was 1.10 which is less than the 1.96 at .05 significance level. This difference has indicated that there is no significant difference between two groups of students. on the understanding of science in Dimension I- Concepts of Science of Understanding Science Scale.

Dimension II- Science Policy :

The table indicated that the Hindu and Muslim students of Government schools have their mean and S. D. as 22.71 and 3.38 and 21.98 and 3.78 respectively. Using critical ratio to determine the difference between two groups the 'CR' value was found to be 2.61 which is

higher than 1.96 at .05 significance level. This difference has indicated that there is significant difference between two groups of students. Hindu students from Government schools possess much higher understanding of Science on dimension II- Science Policy of understanding of Science Scale.

Dimension III- Value Judgement :

The table has indicated that the mean and the S. D. of the Hindu and Muslim from Government schools were found to be 5.82 and 1.56 and 5.29 and 1.48 respectively. While applying critical ratio to determine the difference between two groups, the 'CR' value was found to be 4.42 which is higher than 2.58 at .01 significance level. This difference has indicated that there is significant difference between two groups of students. Hindu students of Government schools possess much higher understanding of science in Dimension III-Value Judgement of Understanding of Science Scale.

Contd....

4.23 Responses of Students of Hindu and Muslim from Private Schools on Understanding of Science

TABLE 4.22

MEAN, S. D. AND CRITICAL RATIO OF STUDENTS OF HINDU AND MUSLIM FROM PRIVATE SCHOOLS ON UNDERSTANDING OF SCIENCE SCALE AND ITS DIMENSIONS

Understanding of Science Scale	Private Schol's Hindu Students (N = 200)		Muslim Students (N =50)		Critical Ratio	
	Mean	S. D.	Mean	S. D.		
Total Score	60.98	4.68	55.51	8.94	4.18	< .01
Dimensions :						
I- Science concepts	29.83	3.14	28.61	4.67	1.74	>.05
II-Science Policy	25.78	2.21	22.15	3.82	6.48	<.01
III- Value Judgement	6.16	1.14	6.06	1.17	0.56	< .05

Discussion :

The above table has indicated that the students of Private schools Hindu(N=200) and Muslim (N=50) have their mean and S. D. as 60.98 and 4.68 and 55.51 and 8.94 respectively. Both these means are higher than the theoretical mean indicating that both the group of students have favourable understanding of science. While using critical ratio to determine the difference between these two groups, 'CR' value was found to be 4.18 which is higher than 2.58 at .01 significance level. This difference has indicated that there is significant difference between two groups of students. Hindu students from Private school possess much more favourable understanding of science.

Dimension I- Concepts of Science :

The above table indicated that the obtained mean and S. D. of Hindu and Muslim students from Private schools were found to be 29.83 and 3.14 and 28.61 and 4.67 respectively. Applying critical ratio to determine the difference between two groups the 'CR' value was 1.74 which is less than the value 1.96 at .05 significance level. This difference has indicated that there is no significant difference between two groups of students. on Dimension I- Concepts of Science on Understanding of Science Scale.

Dimension II- Science Policy :

The above table has indicated that the obtained mean and S.D. of Hindu and Muslim students from Private schools were found to be 25.78 and 2.21 and 22.15 and 3.82 respectively. Applying critical ratio to determine the difference between two groups the 'CR' value was 6.48 which is higher than 2.58 at .01 significance level. This difference has indicated that there is significant difference between two groups of students. The Hindu students of Private schools possess much higher understanding of Science on dimension II- Science Policy of understanding of Science Scale.

Dimension III- Value Judgement :

The above table has indicated that the obtained mean and S. D. of Hindu and Muslim from Private schools were found to be 6.16 and 1.14 and 6.06 and 1.17 respectively. Applying critical ratio to determine

the difference between two groups, the 'CR' value was 0.56 which is less than 1.96 at .05 significance level. This difference has indicated that there is no significant difference between two groups of students on understanding of science in Dimension III-Value Judgement of Understanding of Science Scale.

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CHAPTER V

PERFORMANCE ON SCIENTIFIC TEMPER SCALE

5.1 Introduction

According to Royal Society 1985, "Research is needed on how to measure public understanding, so as to enable monitoring of whether particular actions have changed public understanding of science, and whether such changes in fact bring about their intended consequences." These observations point out that there are two kinds of premises which underlie science. First, the general sociological assumptions concerning the understanding of science related to how people interpret the content and values of science, second, the more particular assumptions underlying the purposes of science education, that is, development of scientific thinking, scientific thought, scientific temper. These assumptions are of considerable importance presenting composite action as related to ideology of science and ethos of science. The fundamental and broad educational directions for science educational directions for science education shall emerge from the ideology and ethos of science as these inherent the values which serve as guidelines.

The ideology of science attempts to describe the 'idea systems' or basic irreducible assumptions that permeate scientific practices. In

otherwords, scientific ideology relates primarily to a system of ideas or a way of thinking that characterise science, but ethos of science attempts to define the more affective aspects of scientific activity (Smolicz and Nunan, 1975). Clearly both the ideology and ethos are interactive, each 'circulatory' affecting the other : further their total effect contributes to image of science. Hodson and Reid (1988) has observed :

> If you genuinely seek an informed and thinking citizenry - capable of considering scientific and technological matters in the context of economic constraints, environmental issues, ethical concerns and social and aesthetic considerations - we must include in our science curriculum a consideration of the impact of science and technology on society, and the influence of society on science, scientific research and scientific development. A related issue is that of ensuring that future scientists and technologists behave in a socially responsible manner.

The authors have further specified affective goals for science education (Hodson, Reid, 1988) :

* Independence of thought and self - confidence.
* Preseverance and tenacity in the face of difficulties.
* Intellectual curiosity.
* Tolerance of the views of others.
* Open mindedness, willingness to change one's mind in the light of new evidence, willingness to suspend judgement if there is insufficient evidence.
* Acceptance of scientific inquiry as a legitimate way of thinking about issues and problems.

* Enthusiasm for Science.
* Application of Science problem solving skills to everyday situations.

These objectives of science education will help the cultivation of scientific outlook or scientific temper which is more important than acquiring scientific knowledge or its application. India need both understanding of science and scientific temper to develop relevant socio-cultural environment for national development, both intellectually and materially.

In this chapter the investigator has analysed the data obtained on Scientific Temper Scale.

5.2 Analysis of the Responses of the Total Sample on Scientific Temper Scale

TABLE 5.1

PERFORMANCE OF TOTAL SAMPLE (N=1000) ON SCIENTIFIC TEMPER SCALE AND ITS DIMENSIONS

Scientific Temper Scale	Mean	S. D.
Total Score	39.38	5.57
Dimensions :		
I- Value Perspective	21.73	3.41
II- Aversion to Superstitions	8.06	2.18
III- A Set of Attitudes	4.28	1.43
IV- A World View Perspective	5.42	1.59

Discussion :

The above table has indicated that the mean and S. D. of total sample (N=1000) has been 39.38 and 5.57 respectively on the Scientific Temper Scale. The obtained mean of the sample is more than the theoretical mean of 30.0. Therefore, it is inferred that the total sample has above average scientific temper. Hence, hypothesis No. 7 has been rejected.

Dimension I - Value Perspective :

The above table has indicated that the mean and S. D. on Dimension I of Scientific Temper Scale of the total sample (N=1000) has been 21.73 and 3.41 respectively. The obtained mean on this dimension is more than the theoretical mean of 16.0. Hence, it is inferred that the sample has positive and favourable value perspective.

Dimension II- Aversion to Superstitions :

Table 5.1 has indicated that the mean and S. D. on Dimension II- Aversion to superstitions of Scientific Temper Scale of the total sample (N=1000) has been 8.06 and 2.18 respectively. The obtained mean on this dimension is more than the theoretical mean of 6.0. Hence, it is inferred, that the sample has aversion to superstitions.

Dimension III- A Set of Attitudes :

Table 5.1 has indicated that the obtained mean is higher than the theoretical mean on this dimension obtained mean is 4.28 and S. D.

is 1.43 which is higher than the theoretical mean of 4.0. Hence, the sample has favourable attitudes towards science and its contribution.

Dimension IV- A World View Perspective :

The table has indicated that the theoretical mean of 4.0 is much less than the obtained mean of 5.42. Therefore, the sample has constructive world view about science and its role in developing a balanced world.

5.3 Analysis of the Responses of Hindu and Muslim Students on Scientific Temper Scale

TABLE 5.2

PERFORMANCE OF HINDU AND MUSLIM STUDENTS ON SCIENTIFIC TEMPER SCALE AND ITS DIMENSIONS

Scientific Temper Scale	Hindu Students (N=600) Mean	S. D.	Muslim Students (N=400) Mean	S. D.	Critical Ratio
Total Score	39.25	4.97	37.94	5.72	3.74 < .01
Dimensions :					
I- Value Perspective	21.58	2.98	20.47	3.56	5.04 < .01
II-Aversion to Superstitions	8.13	1.62	7.13	2.17	7.69 < .01
III- A Set of Attitudes	3.65	1.33	4.86	1.50	13.44 < .01
IV- A World View Perspective	4.19	1.41	4.92	1.67	7.30 < .01

Disucussion :

Table 5.2 has indicated that the mean and S. D. of students of Hindu (N=600) has been 39.25 and 4.97 and that of Muslim has been 37.94 and 5.72 respectively. While applying the critical ratio to determine the difference between the two groups, the 'CR' value was found to be 3.74 which is more than 2.58, hence significant at .01 level. Thus there is difference between the total sample of Hindu and the total sample of Muslim concerning their levels of scientific temper. Hence, hypothesis No. 8 was failed to be retained.

This study has indicated that the students of Hindu reflect higher level of scientific temper than the students of Muslim. There may be many and varied reasons for this.

Dimension I- Value Perspective :

The table has indicated that the mean and S. D. on Dimension-I of Scientific Temper of Hindu students has been 21.58 and 2.98 and that of Muslim has been 20.47 and 3.56 respectively. While applying critical ratio to determine the difference between two groups of students the 'CR' value was found to be 5.04 which is higher than 2.58, hence significant at .01 level. Thus, there is significant difference between the students from two religion on Value Perspective. The Hindu students have higher scientific temper concerning value perspective.

Dimension II- Aversion to Superstitions :

The table has indicated that the mean and S. D. on Dimension

II of Scientific Temper of Hindu has been 8.13 and 1.62 and that of Muslim has been 7.13 and 2.17 respectively. While applying the critical ratio to determine the difference between the two groups of students the 'CR' value was found to be 7.69 whic is higher than the value 2.58. Thus there is significant difference at .01 level between the two religion on Aversion to Superstitions. The Hindu students have higher scientific temper concerning aversion to superstitions.

Dimension III- A Set of Attitudes :

The table has indicated that the mean and S. D. on Dimension III of Scientific Temper of Hindu has been 3.65 and 1.33 and that of Muslim has been 4.86 and 1.50 respectively while applying critical ratio to determine the difference between the two groups of students the value was found to be 13.44 wich is higher than the value 2.58, hence significant at .01 level. Thus there is significant difference between the two religion on Dimension III. The Hindu students possess more scientific temper concerning set of attitude.

Dimension IV - A World View Perspective :

The table indicated that the mean and S. D. on Dimension of Scientific Temper of Hindu has been 4.19 and 1.41 and that of Muslim has been 4.92 and 1.67 respectively. While applying the critical ratio to determine the difference between the two groups of students the 'CR' value was found to be 7.30 which is higher than the value of 2.58, hence significant at .01 level. Thus there is significant difference between the

two religion on Dimension IV. The Hindu students possess more scientific temper concerning world view perspective.

5.4 Analysis of Responses of Total Sample From Class 9th and 10th to Determine their Scientific Temper

Table 5.3

MEAN, S. D. AND CRITICAL RATIO OF 9TH CLASS STUDENTS AND 10TH CLASS STUDENTS ON SCIENTIFIC TEMPER AND ITS DIMENSIONS

Scientific Temper Scale	9th Class Students (N=660) Mean	S. D.	10th Class Students (N=340) Mean	S. D.	Critical Ratio
Total Score	38.13	5.85	41.14	5.97	7.53 < .01
Dimensions :					
I- Value Perspective	20.86	3.59	21.77	3.74	3.64 < .01
II-Aversion to Superstitions	7.72	2.16	7.97	2.07	1.78 > .05
III- A Set of Attitudes	4.16	1.25	4.89	1.23	9.12 < .01
IV- A World View Perspective	4.94	1.37	4.72	1.23	2.75 < .01

Disucussion :

The above table has indicated that the mean of 9th class studnets and 10th class students has been 38.13 and 41.14 and S. D. 5.85 and 5.97. While applying the critical ratio to determine the difference between two groups, the 'CR' value was found to be 7.53 which is higher than the value of 2.58. Therefore, hypothesis No. 9 has been rejected. Hence, it is inferred that 10th class students possess higher level of scientific temper in comparison to 9th class students.

Dimension I- Value Perspective :

The table 5.3 indicated that the mean and S. D. on Dimension I of Scientific Temper of 9th class and 10th class students have obtained mean 20.86 and 21.77 and S. D. 3.59 and 3.74 respectively. While applying critical ratio to determine the difference between two groups of students the 'CR' value was found to be 3.64 which is higher than 2.58. Therefore, it can be inferred that the students of 10th class possess higher level of scientific temper than the students of 9th class concerning value perspective of the scientific temper.

Dimension II- Aversion to Superstitions :

The table has indicated that the mean and S. D. on Dimension II of Scientific Temper Scale of 9th class studnets and 10th class students have obtained mean 7.72 and 7.97 and S. D. 2.16 and 2.07 respectively. While applying the critical ratio to determine the difference between the two classes the 'CR' value was found to be 1.78, which is less than the value 1.96, hence not significant at .05 level. Therefore, it can be inferred the their is no difference between 9th and 10th class students concerning dimension II- Aversion to superstition of Scientific Temper.

Dimension III- A Set of Attitudes :

The table has indicated that mean and S. D. on Dimension III of Scientific Temper Scale of 9th class students and 10th class students have obtained mean 4.16 and 4.89 and S. D. 1.25 and 1.23 respectively. While applying critical ratio to determine the difference between the two

classess the 'CR' value was found to be 9.12 which is higher than the value 2.58. This difference has indicated that the students of 10th class have higher scientific temper than the students of 9th class concerning dimension III- A set of attitude.

Dimension IV - A World View Perspective :

The table has indicated that mean and S. D. on Dimension of Scientific Temper Scale of 9th calss students and 10th class students have obtained 4.94 and 4.72 and S. D. 1.37 and 1.23 respectively. While applying the critical ratio to determine the difference between the two groups the 'CR' value was found to be 2.75 which is higher than the value of 2.58. This significant difference has indicated that the students of 10th class have higher scientific temper than the students of 9th calss concerning Dimension IV- A world View Perspective.

Contd....

5.5 Analysis of Responses of the Male and Female Students on Scientific Temper Scale

TABLE 5.4

MEAN, S. D. AND CRITICAL RATIO OF MALE AND FEMALE STUDENTS ON SCIENTIFIC TEMPER SCALE

Scientific Temper Scale	Male Students (N=650) Mean	S. D.	Female Students (N=350) Mean	S. D.	Critical Ratio
Total Score	39.74	4.31	39.85	4.49	0.38 < .05
Dimensions :					
I- Value Perspective	21.65	2.78	21.81	2.98	0.84 > .05
II-Aversion to Superstitions	7.82	1.93	7.63	1.91	1.46 > .05
III- A Set of Attitudes	4.49	1.52	4.79	1.49	3.00 < .01
IV- A World View Perspective	5.51	1.18	5.68	1.16	2.13 < .05

Disucussion :

The table has indicated that the mean and S. D. of Male students was found to be 39.74 and 4.31 respectively. Similarly, the mean and S. D. of female students was 39.85 and 4.49. The 'CR' value has been 0.38 which is much less than the value of 1.96, hence not significant at .05 level. This has proved that there was no difference of scientific temper due to differences in sex. Hence, hypothesis No. 10 has been retained.

Dimension I- Value Perspective :

The above table has indicated that the male students have

obtained mean 21.65 and S. D. 2.78 on dimension - Vaue perspective. Similarly, female students have obtained mean 21.81 and S. D. 2.98 on this dimension. While using the critical ratio to determine the difference on dimension, Value perspective the 'CR' value found to be was 0.84 which has indicated that the difference is not significant due to sex differences.

Dimension II- Aversion to Superstitions :

The above table has indicated that the male students have obtained mean 7.82 and S. D. 1.93 on Dimension Aversion to Superstitions on the scientific temper scale. Similarly, famale students have obtained mean 7.63 and S. D. 1.91 on this dimension. While using critical ratio to determine the level of difference, 'CR' value was found to be 1.46 which is less than the value 1.96, hence not significant at .05 level. Thus there is no difference concerning aversion to superstition due to sex difference.

Dimension III- A Set of Attitudes :

The above table has indicated that the male students (N=650) have obtained mean 4.49 and S. D. 1.52 on dimension a set of attitudes of the Scientific Temper Scale. Similarly female students (N=350) have obtained mean 4.79 and S. D. 1.49. The 'CR' value obtained after using the critical ratio has been 3.00 which is more than 2.58, hence significant at .01 level, indicating significant difference of attitudes due to sex difference.

Dimension IV - A World View Perspective :

The above table has indicated that the male students have obtained mean 5.51 and S. D. 1.18 on dimension A World View Perspecitve of the Scientific Temper Scale. Similarly, female students have obtained mean 5.68 and S. D. 1.16. While applying critical ratio to determine the difference due to sex defference, the 'CR' value was found to be 2.13 which is higher than the value 1.96, significant at .05 level. Therefore, there is significant difference concerning world view perspective due to sex differences. The female students have more world view perspecitve concerning scientific temper.

5.6 Analysis of Responses of the Rural and Urban students on Scientific Temper Scale

TABLE 5.5

MEAN, S. D. AND CRITICAL RATIO OF RURAL AND URBAN STUDENTS ON SCIENTIFIC TEMPER SCALE

Scientific Temper Scale	Rural Students (N=200) Mean	S. D.	Urban Students (N=800) Mean	S. D.	Critical Ratio
Total Score	35.53	6.41	39.38	5.54	7.86 < .01
Dimensions :					
I- Value Perspective	19.65	3.33	21.43	3.17	6.85 < .01
II-Aversion to Superstitions	5.85	2.38	7.77	2.17	10.67 < .01
III- A Set of Attitudes	4.07	1.26	4.39	1.20	3.20 < .01
IV- A World View Perspective	4.63	1.38	4.97	1.21	3.09 < .01

Disucussion :

The table has indicated that the mean and S. D. of students from schools located in rural area and students from urban schools has been 35.53 and 39.38 and S. D. 6.41 and 5.54 respectively. While applying the critical ratio to determine the difference between two groups, the 'CR' value was found to be 7.86 which is more than the value 2.58, hence significant at .01 level. Therefore, hypothesis No. 11 has been rejected. It is inferred that the students from schools situated in urban areas have much higher level of scientific temper than the students from rural areas schools.

Dimension I- Value Perspective :

The above table indicated that the mean and S. D. on dimension I- of Sicentific temper scale of students from rural schools and students from urban schools have obtained 19.65 and 21.43 and S. D. 3.33 and 3.17 respectively. While applying critical ratio to determine the difference between the two groups the 'CR' value was found to be 6.85 which is more than the value 2.58, hence significant at .01 level. Therefore, students from urban schools possess higher level of scientific temper concerning value perspective than the students from rural schools.

Dimension II- Aversion to Superstitions :

The above table has indicated that the mean and S. D. on dimension II- of Scientific temper scale of rural students and urban students have obtained 5.85 and 7.77 and S. D. 2.38 and 2.17

respectively. While applying critical ratio to determine the level of difference between the two groups the 'CR' value was found to be 10.67 which is more than the value 2.58, hence significant at .01 level. Therefore, students from urban schools possess higher level of scientific temper concerning aversion to superstition.

Dimension III- A Set of Attitudes :

The table indicated that mean and S. D. of dimension III of Scientific temper scale of rural and urban students have obtained mean 4.07 and 4.39 and S. D. 1.26 and 1.20 respectively. While applying the critical ratio to determine the difference between two groups, the 'CR' value was found to be 3.20 which is higher than the value 2.58, hence significant at .01 level. This significant difference has indicated that the students from urban area have higher scientific temper on dimension III- A set of attitudes of scientific temper.

Dimension IV - A World View Perspective :

The table has indicated that mean and S. D. of Dimension IV of Scientific temper scale of rural and urban students have obtained mean 4.63 and 4.97 and S. D. 1.38 and 1.21 respectively. While applying critical ratio to determine the difference between two groups, the 'CR' value was found to be 3.09 which is higher than the value 2.58, hence significant at .01 level. This difference has indicated that the students from urban area have higher scientific temper in dimension IV - A world view perspective.

5.7 Analysis of Responses of Students from Government Schools and Private Schools on Scientific Temper Scale

TABLE 5.6

MEAN, S. D. AND CRITICAL RATIO OF STUDENTS FROM GOVERNMENT SCHOOLS AND PRIVATE SCHOOLS ON SCIENTIFIC TEMPER SCALE ITS DIMENSIONS

Scientific Temper Scale	Government School Students (N=750)		Private School Students (N=250)		Critical Ratio
	Mean	S. D.	Mean	S. D.	
Total Score	38.23	5.93	41.16	3.38	9.77 < .01
Dimensions :					
I- Value Perspective	20.93	2.89	22.26	2.34	7.39 < .01
II-Aversion to Superstitions	6.98	2.19	8.68	1.56	13.08 < .01
III- A Set of Attitudes	4.18	1.46	4.07	1.43	1.10 > .05
IV- A World View Perspective	5.36	1.52	5.98	1.32	6.20 < .01

Disucussion :

The above table has indicated that the students from Government schools (N=750) have obtained mean 38.23 and S. D. 5.93. Similarly, students from Private schools (N=250) have obtained mean 41.16 and S. D. 3.38. While applying critical ratio to determine the difference between two groups, the 'CR' value was found to be 9.77 which is more than the value 2.58, hence significant at .01 level. The difference has indicated that there is difference between students of Government schools and students of Private schools concerning their level of scientific

temper. The students of private schools definitely possess high level of scientific temper. Hence, the hypothesis No. 12 has been rejected.

Dimension I- Value Perspective :

The table has indicated that the students of Government schools have obtained mean 20.93 and S. D. 2.89 on the dimension of Scientific temper scale. Similarly, students from Private schools have obtained mean 22.26 and S. D. 2.34. While applying the critical ratio to determine the difference between the groups on this dimension, the 'CR' value was found to be 7.39 which is more than the value 2.58, hence significant at .01 level. The finding has indicated that the students of Private schools possess much more favourable positive value perspective on scientific Temper Scale. This is feasible due to school climate, socio - cultural background of students or the scientific thought among the teachers.

Dimension II- Aversion to Superstitions :

The table has indicated that the students of the Government schools and students from Private schools have obtained mean 6.98 and 8.68 and S. D. 2.19 and 1.56 respectively. While applying critical ratio to determine the difference between two groups the 'CR' value was found to be 13.08, hence significant at .01 level. Thus, there is a significant difference between two groups concerning Aversion to Superstition. This may due to socio-educational backdrop of the family and exposure of students to the values of science.

Dimension III- A Set of Attitudes :

The table has indicated that the students from Government schools have obtained mean 4.18 and S. D. 1.46 on dimension A set of attitudes on Scientific temper scale. Similary, students from Private schools have obtained mean 4.07 and S. D. 1.43. The 'CR' value obtained after applying critical ratio wsa 1.10 which is less than 1.96, hence not significant at .05 level. Therefore, these is no significant difference between Government schools students and Private schools students concerning attitudes of scientific temper scale.

Dimension IV - A World View Perspective :

The table has indicated that students of Government schools (N=750) have obtained mean 5.36 and S. D. 1.52 on this dimension, A world view Perspective of Scientific Temper Scale. Similarly, students of Private schools (N=250) have obtained mean 5.98 and S. D. 1.32. While applying critical ratio to get the difference between two groups, the 'CR' value was 6.20 which is higher than the value 2.58, This has clearly shown that the students of Private schools possess favourable and constructive world view Perspective regarding socio - scientific issues.

5.8 Responses of 9th class Students of Hindu and 9th class Students of Muslim on Scientific Temper Scale

TABLE 5.7

MEAN, S. D. AND CRITICAL RATIO OF 9TH CLASS STUDENTS OF HINDU AND MUSLIM ON SCIENTIFIC TEMPER SCALE AND ITS DIMENSIONS

Scientific Temper Scale	9th Class Hindu Students (N=410) Mean	S. D.	9th Class Muslim Students (N=250) Mean	S. D.	Critical Ratio
Total Score	38.52	4.97	36.27	5.93	5.00 < .01
Dimensions :					
I- Value Perspective	21.87	2.98	19.62	3.18	9.00 < .01
II-Aversion to Superstitions	7.95	1.27	6.93	2.28	6.38 < .01
III- A Set of Attitudes	4.16	1.36	4.85	1.58	5.75 < .01
IV- A World View Perspective	5.18	1.23	5.10	1.59	0.67 > .05

Disucussion :

The above table has indicated that the mean and S. D. 9th class students of Hindu was found to be 38.52 and 4.97. Similarly the mean and S. D. of 9th class students of Muslim was found to be 36.27 and 5.93 respectively. The 'CR' value was found to be 5.00 which is higher than the value 2.58, hence significant at .01 level. Therefore it is inferred that the 9th class students of Hindu possess higher level of Scientific Temper in comparison to 9th class students of Muslim.

Dimension I- Value Perspective :

The table 5.7 indicated that the mean and S. D. of the students of 9th class of Hindu and Muslim have obtained 21.87 and 2.98 and 19.62 and 3.18 respectively. Using critical ratio to determine the difference between two groups of students the value was found to be 9.00 which is higher than the value 2.58 at .01 significance level. Therefore, it can be inferred that the students of 9th class of Hindu possess higher level of scientific temper than the 9th class students of Muslim on Value perspective of scientific temper.

Dimension II- Aversion to Superstitions :

The table indicated that the mean and S. D. on dimension II of Scientific temper scale of 9th class students of Hindu have obtained mean 7.95 and S. D. 1.27 and that of Muslim is 6.93 and 2.28 respectively. The critical ratio was found to be 6.38 which is higher than the value 2.58, hence significant at .01 level. This has indicated that there is significant difference between two groups of students. 9th class students of Hindu possess more favourable level of scientific temper than the 9th class students of Muslim concerning Aversion to Superstitions.

Dimension III- A Set of Attitudes :

The table has indicated that the mean and S. D. of 9th class students of Hindu and Muslim was found to be 4.16 and 1.36 and 4.85 and 1.58 respectively. Using critical ratio to determine the difference

between the two groups the 'CR' value was found to be 5.75 which is higher than the value 2.58, hence significant at .01 level. Therefore, it can be inferred that there is significant difference between two groups of students. 9th class students of Muslim possess higher level of scientific temper than the 9th class students of Hindu concerning a set of attitudes.

Dimension IV - A World View Perspective :

The table has indicated that mean and S. D. of the 9th class students of Hindu and Muslim was found to be 5.18 and 1.23 and 5.10 and 1.59 respectively. Using critical ratio to determine the difference between the two groups the 'CR' value was found to be 0.67 which is less than the value 1.96, hence not significant at .05 level. This has indicated that there is no significant difference between 9th class students of Hindu and Muslim on scientific temper concerning a word view perspective.

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5.9 Analysis of Responses of 10th class Students of Hindu and Muslim on Scientific Temper Scale

TABLE 5.8

MEAN, S. D. AND CRITICAL RATIO OF 10TH CLASS STUDENTS OF HINDU AND MUSLIM ON SCIENTIFIC TEMPER SCALE AND ITS DIMENSIONS

Scientific Temper Scale	10th Class Hindu Students (N=190) Mean	S. D.	10th Class Muslim Students (N=150) Mean	S. D.	Critical Ratio
Total Score	41.46	4.95	39.19	5.86	3.78 < .01
Dimensions :					
I- Value Perspective	23.59	2.16	21.49	2.96	7.24 < .01
II-Aversion to Superstitions	7.89	1.48	7.48	1.93	2.16 < .05
III- A Set of Attitudes	4.18	1.27	4.66	1.33	3.43 < .01
IV- A World View Perspective	5.43	1.23	5.18	1.37	1.79 > .05

Disucussion :

The above table has indicated that the mean and S. D. of 10th class students of Hindu and 10th class students of Muslim were found to be 41.46 and 4.95 and 39.19 and 5.86 respectively. Applying critical ratio to determine the difference between two groups, the 'CR' value was found to be 3.78 which is higher than the value 2.58, hence significant at .01 level. This has proved that there is significant difference between the two groups of students. The 10th class students of Hindu have higher scientific temper than the 10th class students of Muslim.

Dimension I- Value Perspective :

The table has indicated that the mean and S. D. of 10th class students of Hindu and Muslim were found to be 23.59 and 2.16 and 21.49 and 2.96 respectively. The 'CR' value was found to be 7.24 which is higher than the value 2.58, hence significant at .01 level. This has proved that the 10th class students of Hindu have higher scientific temper than the 10th class students of Muslim concerning value perspective of scientific temper.

Dimension II- Aversion to Superstitions :

The table has indicated that the mean and S. D. of 10th class students of Hindu and Muslim were found to be 7.89 and 1.48 and 7.48 and 1.93 respectively. The 'CR' value was found to be 2.16 which is higher than the value 1.96, hence significant at .05 level. This has inferred that the 10th class students of Hindu have higher Scientific Temper than the 10th class students of Muslim concerning dimension II- Aversion to superstitions.

Dimension III- A Set of Attitudes :

The table has indicated that the mean and S. D. of 10th class students of Hindu and 10th class students of Muslim were found to be 4.18 and 1.27 and 4.66 and 1.33 respectively. The 'CR' value was found to be 3.43, significant at .01 level. This has indicated that there is significant difference between the two groups of students on scientific temper scale concerning a set of attitudes.

Dimension IV - A World View Perspective :

The table has indicated that the mean and S. D. of 10th class students of Hindu and 10th class students of Muslim were found to be 5.43 and 1.23 and 5.18 and 1.37 respectively. The 'CR' value was found to be 1.79, which is less than the value 1.96, hence not significant at .05 level. This has indicated that there is no significant difference between the two groups of students concerning a world view perspective of scientific temper.

5.10 Responses of Male Students of Hindu and Muslim on Scientific Temper Scale

TABLE 5.9

MEAN, S. D. AND CRITICAL RATIO OF MALE STUDENTS OF HINDU AND MUSLIM ON SCIENTIFIC TEMPER SCALE AND ITS DIMENSIONS

Scientific Temper Scale	Male Hindu Students (N=367) Mean	S. D.	Male Muslim Students (N=233) Mean	S. D.	Critical Ratio
Total Score	40.44	4.58	39.51	5.34	2.21 < .05
Dimensions :					
I- Value Perspective	21.64	2.86	20.75	2.93	3.71 < .01
II-Aversion to Superstitions	7.94	1.48	7.73	2.16	1.31 > .05
III- A Set of Attitudes	4.23	1.37	4.91	1.46	5.67 < .01
IV- A World View Perspective	5.24	1.46	5.13	1.67	0.85 > .05

Disucussion :

The above table indicated that the mean and S. D. of Male students of Hindu and Male students of Muslim possess 40.44 and 4.58 and 39.51 and 5.34 respectively. Applying critical ratio to determine the difference between two groups, The 'CR' value was found to be 2.21 which is higher than the value 1.96, significant at .01 level. It is evident from this difference that there is significant difference between the two groups of students. The male students of Hindu have higher scientific temper than the male students of Muslim.

Dimension I- Value Perspective :

The table has indicated that the mean and S. D. of male students of Hindu and male students of Muslim have obtained 21.64 and 2.86 and 20.75 and 2.93 respectively. The 'CR' was found to be 3.71, which is higher than the value 2.58, significant at .01 level. This has indicated that there is significant difference between the two groups of students on scientific temper scale. The male students of Hindu possess higher scientific temper concerning Value Perspective than the male students of Muslim.

Dimension II- Aversion to Superstitions :

The table has indicated that the male students of Hindu and the male students of Muslim possess mean and S. D. of 7.94 and 1.48 and 7.73 and 2.16 respectively. The 'CR' value was found to be 1.31 which is less than the value 1.96, hence not significant at .05 level. This

has indicated that there is no significant difference between the two groups of students on scientific temper concerning Aversion to superstitions.

Dimension III- A Set of Attitudes :

The table has indicated that the mean and S. D. of the male students of Hindu and male studnets of Muslim have obtained mean and S. D. of 4.23 and 1.37 and 4.91 and 1.46 respectively. The 'CR' value was found to be 5.67 which is higher than the value 2.58, hence significant at .01 level. This has inferred that there is significant difference between the two groups of students in Scientific temper. The male students of Muslim have higher scientific temper concerning a set of attitudes than the male students of Hindu.

Dimension IV - A World View Perspective :

The table has indicated that the mean and S. D. of the male students of Hindu and male students of Muslim have obtained mean and S. D. of 5.24 and 1.46 and 5.13 and 1.67 respectively. The 'CR' value was found to be 0.85 which is less than the value 1.96, hence not significant at .05 level. This has proved that there is no significant difference between the two groups of students in scientific temper.

5.11 Responses of Female Students of Hindu and Muslim on Scientific Temper Scale

TABLE 5.10

MEAN, S. D. AND CRITICAL RATIO OF FEMALE STUDENTS OF HINDU AND MUSLIM ON SCIENTIFIC TEMPER SCALE AND ITS DIMENSIONS

Scientific Temper Scale	Female Hindu Students (N=233) Mean	S. D.	Female Muslim Students (N=167) Mean	S. D.	Critical Ratio	
Total Score	39.48	5.16	38.43	6.71	1.69	> .05
Dimensions :						
I- Value Perspective	21.98	3.23	20.43	3.93	4.19	< .01
II-Aversion to Superstitions	7.61	1.43	7.18	2.28	2.15	< .05
III- A Set of Attitudes	4.38	1.39	4.76	1.40	2.71	< .01
IV- A World View Perspective	5.89	1.36	5.23	1.41	4.71	< .01

Disucussion :

The above table has indicated that the mean and S. D. of the female students of Hindu (N=233) and the female students of Muslim (N=167) have obtained 29.48 and 5.16 and 38.43 and 6.71 respectively. The 'CR' value was found to be 1.69 which is less than the value 1.96, hence not significant at .05 level. This has proved that there is no significant difference between the two groups of students in scientific temper.

Dimension I- Value Perspective :

The table has indicated that the mean and S. D. of female students of Hindu and the female students of Muslim have 21.98 and 3.23 and 20.43 and 3.93 respectively. The 'CR' was found to be 4.19 which is higher than the value 2.58, hence significant at .01 level. This has inferred that there is significant difference between the two groups of students on scientific temper scale. The female students of Hindu possess higher scientific temper concerning Value Perspective.

Dimension II- Aversion to Superstitions :

The table has indicated that the mean and S. D. of the female students of Hindu and the female students of Muslim have 7.61 and 1.43 and 7.18 and 2.28 respectively. The 'CR' value was found to be 2.15 which is higher than the value 1.96, hence significant at .05 level. This has inferred that there is significant difference between the two groups of students. The female students of Hindu possess higher scientific temper than the female students of Muslim concerning aversion to superstitions.

Dimension III- A Set of Attitudes :

The table has indicated that the mean and S. D. of the female students of Hindu and the female studnets of Muslim obtained 4.38 and 1.39 and 4.76 and 1.40 respectively. The 'CR' value was found to be 2.71 which is higher than the value 20.58, hence significant at .01 level. This has indicated that there is significant difference between the two

groups of students. The female students of Hindu have higher scientific temper than the female students of Muslim concerning a set of attitudes.

Dimension IV - A World View Perspective :

The table has indicated that the mean and S. D. of the female students of Hindu and the female students of Muslim possess 5.89 and 1.36 and 5.23 and 1.41 respectively. The 'CR' value was found to be 4.71 which is more than the value 2.58, hence significant at .01 level. This difference has indicated that there is significant difference between the female students of Hindu and the female students of Muslim in scientific temper scale concerning a world view perspective. Female students of Hindu possess more world view perspective concerning scientific temper.

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5.12 Responses of Rural Students of Hindu and Muslim on Scientific Temper Scale

TABLE 5.11

MEAN, S. D. AND CRITICAL RATIO OF RURAL STUDENTS OF HINDU AND MUSLIM ON SCIENTIFIC TEMPER SCALE AND ITS DIMENSIONS

Scientific Temper Scale	Rural Hindu Students (N=117) Mean	S. D.	Rural Muslim Students (N=83) Mean	S. D.	Critical Ratio	
Total Score	34.83	5.48	35.79	6.87	1.05	> .05
Dimensions :						
I- Value Perspective	18.42	3.11	20.34	3.91	3.69	< .01
II-Aversion to Superstitions	6.94	2.14	5.17	2.38	5.36	< .01
III- A Set of Attitudes	4.23	1.37	4.97	1.47	3.70	< .01
IV- A World View Perspective	4.98	1.62	4.47	1.59	2.22	< .05

Disucussion :

The above table has indicated that the mean and S. D. of the rural students of Hindu and rural students of Muslim have obtained 34.83 and 5.48 and 35.79 and 6.87 respectively. The 'CR' value was found to be 1.05 which is less than the value 1.96, hence not significant at .05 level. This has indicated that there is no significant difference between the rural students of Hindu and the rural students of Muslim on scientific temper scale.

Dimension I- Value Perspective :

The table has indicated that the mean and S. D. of rural students of Hindu and the rural students of Muslim have obtained 18.42 and 3.11 and 20.34 and 3.91 respectively. The 'CR' value was found to be 3.69 which is higher than the value 2.58, hence significant at .01 level. This has indicated that there is significant difference between the two groups of students. The rural students of Hindu possess higher scientific temper concerning value perspective.

Dimension II- Aversion to Superstitions :

The table has indicated that the mean and S. D. of the rural students of Hindu and the rural students of Muslim have obtained 6.94 and 2.14 and 5.17 and 2.38 respectively. The 'CR' value was found to be 5.36 which is higher than the value 2.58, hence significant at .01 level. This has shown that there is significant difference between the two groups of students. The rural students of Hindu have higher scientific temper concerning aversion to superstitions than the rural students of Muslim.

Dimension III- A Set of Attitudes :

The table has indicated that the mean and S. D. of the rural students of Hindu and the rural studnets of Muslim have obtained 4.23 and 1.37 and 4.97 and 1.47 respectively. The 'CR' value was found to be 3.70 which is higher than the value 2.58, hence significant at .01 level. This has indicated that there is significant difference between the

two groups of students. The rural students of muslim possess higher scientific temper than the rural students of Hindu concerning a set of attitudes.

Dimension IV - A World View Perspective :

The above table has indicated that the mean and S. D. of the rural students of Hindu and the rural students of Muslim have obtained 4.98 and 1.62 and 4.47 and 1.59 respectively. This difference has indicated that there is significant difference between the two groups of students. The rural students of Hindu possess higher scientific temper concerning a world view perspective than the rural students of Muslim.

5.13 Responses of Urban Students of Hindu and Muslim on Scientific Temper Scale

TABLE 5.12

MEAN, S. D. AND CRITICAL RATIO OF URBAN STUDENTS OF HINDU AND MUSLIM ON SCIENTIFIC TEMPER SCALE AND ITS DIMENSIONS

Scientific Temper Scale	Urban Hindu Students (N=483) Mean	S. D.	Urban Muslim Students (N=317) Mean	S. D.	Critical Ratio	
Total Score	41.13	4.36	39.91	5.35	3.39	< .01
Dimensions :						
I- Value Perspective	22.27	2.78	20.14	2.97	10.14	< .01
II-Aversion to Superstitions	8.17	1.67	8.04	2.08	0.93	> .05
III- A Set of Attitudes	4.62	1.34	4.99	1.45	3.70	< .01
IV- A World View Perspective	5.88	1.43	5.16	1.69	6.00	< .01

Disucussion :

The above table has indicated that the mean and S. D. of the urban students of Hindu and urban students of Muslim have obtained 41.13 and 4.36 and 39.91 and 5.35 respectively. The 'CR' value was found to be 3.39 which is higher than the value 2.58, hence significant at .01 level. This has indicated that the urban students of Hindu possess higher scientific temper than the urban students of Muslim.

Dimension I- Value Perspective :

The table has indicated that the students from urban areas of Hindu and Muslim have obtained mean and S. D. of 22.27 and 2.78 and 20.14 and 2.97 respectively. The 'CR' value was found to be 10.14 which is higher than the value 2.58, hence significant at .01 level. This has indicated that the urban students of Hindu possess higher scientific temper concerning Value Perspective.

Dimension II- Aversion to Superstitions :

The table has indicated that the mean and S. D. of the urban students of Hindu and the urban students of Muslim have obtained 8.17 and 1.67 and 8.04 and 2.08 respectively. The 'CR' value was found to be 0.93 which is less than the 'CR' value 1.96, hence not significant at .05 level. This has indicated that there is no significant difference between urban students of Hindu and Muslim on scientific temper concerning aversion to superstitions.

Dimension III- A Set of Attitudes :

The above table has indicated that the mean and S. D. of the urban students of Hindu and the urban studnets of Muslim has obtained 4.62 and 1.34 and 4.99 and 1.45 respectively. The 'CR' value was found to be 3.70 which is higher than the value 2.58, hence significant at .01 level. This has indicated that the urban students of Muslim have higher scientific temper than the urban students of Hindu concerning a set of attitudes.

Dimension IV - A World View Perspective :

The table has indicated that the mean and S. D. of the urban students of Hindu and the urban students of Muslim have obtained 5.88 and 1.43 and 5.16 and 1.69 respectively. The 'CR' value was found to be 6.00 which is higher than the value 2.58, hence significant at .01 level. This has indicated that the urban students of Hindu possess higher scientific temper than the urban students of Muslim concerning a world view perspective.

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5.14 Responses of Government School Students of Hindu and Muslim on Scientific Temper Scale

TABLE 5.13

MEAN, S. D. AND CRITICAL RATIO OF GOVERNMENT SCHOOL STUDENTS OF HINDU AND MUSLIM ON SCIENTIFIC TEMPER SCALE AND ITS DIMENSIONS

Scientific Temper Scale	Government School				Critical Ratio	
	Hindu Students (N=400)		Muslim Students (N=350)			
	Mean	S. D.	Mean	S. D.		
Total Score	38.93	4.35	38.67	5.55	0.70	> .05
Dimensions :						
I- Value Perspective	20.91	2.98	20.49	3.37	1.83	> .05
II-Aversion to Superstitions	7.92	1.93	7.19	2.03	4.87	< .01
III- A Set of Attitudes	4.57	1.31	4.76	1.32	1.90	> .05
IV- A World View Perspective	5.45	1.29	5.41	1.35	0.40	> .05

Disucussion :

The above table has indicated that the Hindu and Muslim students from Government schools have mean and S. D. 38.93 and 4.35 and 38.67 and 5.55 respectively. The 'CR' value was found to be 0.70 which is less than the value 1.96, hence not significant at .05 level. This difference has indicated that there is no significant difference between the two groups of students in scientific temper scale.

Dimension I- Value Perspective :

The above table has indicated that the mean and S. D. of the

Hindu and Muslim students from Govt. Schools are 20.91 and 2.98 and 20.49 and 3.37 respectively. The 'CR' value was found to be 1.83 which is less than the value 1.96, hence not significant at .05 level. This has indicated that there is no significant difference between the two groups of students of Hindu and Muslim students from Govenment Schools concerning value perspective in scientific temper scale.

Dimension II- Aversion to Superstitions :

The table has indicated that the mean and S. D. of the Hindu and Muslim students from Govt. Schools have 7.92 and 1.93 and 7.19 and 2.03 respectively. The 'CR' value was found to be 4.87 which is more than the value 2.58, hence significant at .01 level. This has indicated that there is significant difference between the Hindu and Muslim students from Government schools concerning aversion to superstitions. The Hindu students from Govt. schools possess less superstitions.

Dimension III- A Set of Attitudes :

The above table has indicated that the mean and S. D. of the Hindu and Muslim from Government schools have 4.57 and 1.31 and 4.76 and 1.32 respectively. The 'CR' value was found to be 1.90 which is less than the value 1.96, hence not significant at .05 level. This has inferred that there is no significant difference between Hindu and Muslim students from Govt. schools in a set of attitudes, concerning scientific temper.

Dimension IV - A World View Perspective :

The above table has indicated that the mean and S. D. of the Hindu and Muslim students from Government school are 5.45 and 1.29 and 5.41 and 1.35 respectively. The 'CR' value was found to be 0.40 which is less than the value 1.96, hence not significant at .05 level. This has indicated that there is no significant difference between the Hindu and Muslim students from Government schools concerning a world view perspective of scientific temper.

5.15 Responses of Private School Students of Hindu and Muslim on Scientific Temper Scale

TABLE 5.14

MEAN, S. D. AND CRITICAL RATIO OF PRIVATE SCHOOL STUDENTS OF HINDU AND MUSLIM ON SCIENTIFIC TEMPER SCALE AND ITS DIMENSIONS

Scientific Temper Scale	Private School				Critical Ratio	
	Hindu Students (N=200)		Muslim Students (N=50)			
	Mean	S. D.	Mean	S. D.		
Total Score	38.73	4.36	41.21	4.13	3.76	< .01
Dimensions :						
I- Value Perspective	20.79	2.98	22.48	2.73	5.28	< .01
II-Aversion to Superstitions	7.98	1.87	8.74	1.99	2.45	< .05
III- A Set of Attitudes	4.57	1.15	5.12	1.16	3.05	< .01
IV- A World View Perspective	5.45	1.29	5.43	1.67	0.40	> .05

Disucussion :

The above table has indicated that the mean and S. D. of private school students of Hindu and Muslim are 38.73 and 4.36 and 41.21 and 4.13 respectively. The 'CR' value was found to be 3.76 which is higher than the value 2.58 at .01 significant level. This difference has indicated that there is significant difference between the two groups of students. The private students of Muslim have higher scientific temper than the private students of Hindu.

Dimension I- Value Perspective :

The table indicated that the mean and S. D. of private schools students of Hindu and Muslim have obtained 20.79 and 2.98 and 22.48 and 2.73 respectively. The 'CR' value was found to be 5.28 which is higher than the value 2.58 at .01 significant level. This difference has indicated that there is significant difference between the two groups. The private schools students of Muslim possess higher scientific temper than the private students of Hindu concerning Value Perspective.

Dimension II- Aversion to Superstitions :

The table indicated that the mean and S. D. of the private school students of Hindu and Muslim are 7.98 and 1.87 and 8.74 and 1.99 respectively. The 'CR' value was found to be 2.45 which is higher than the value 1.96 at .05 significant level. This difference has indicated that there is significant difference between the students of two religion.

The private school students of Muslim have higher scientific temper than the private school students of Hindu concerning Aversion to Superstitions.

Dimension III- A Set of Attitudes :

The above table has indicated that the mean and S. D. of the private school students of Hindu and Muslim have found to be 4.57 and 1.15 and 5.12 and 1.16 respectively. The 'CR' value was found to be 3.05 which is higher than the value 2.58 at .01 significant level. This difference has indicated that there is significant difference between the two groups of students. The private school students of Muslim were found to higher in scientific temper than the private students of Hindu

Dimension IV - A World View Perspective :

The above table has indicated that the mean and S. D. of the private school students of Hindu and Muslim have found to be 5.45 and 1.29 and 5.43 and 1.67 respectively. The 'CR' value was found to be 0.08 which is less than the value 1.96 at .05 significant level. This difference has indicated that there is no significant difference between the two groups of students on scientific temper scale in a world view perspective.

5.16 Responses of 9th and 10th class students of Hindu on Scientific Temper Scale

TABLE 5.15

MEAN, S.D. AND CRITICAL RATIO OF 9TH AND 10TH CLASS STUDENTS OF HINDU ON SCIENTIFIC TEMPER SCALE AND ITS DIMENSIONS

Scientific Temper Scale	9th class Hindu Students (N=410) Mean	S. D.	10th class Hindu Students (N=190) Mean	S. D.	Critical Ratio
Total Score	37.73	4.47	41.53	4.34	10.00 < .01
Dimensions :					
I- Value Perspective	21.31	2.98	23.48	2.16	10.33 < .01
II-Aversion to Superstitions	7.54	1.47	7.85	1.38	2.58 < .01
III- A Set of Attitudes	3.81	1.17	3.68	1.21	1.18 > .05
IV- A World View Perspective	5.18	1.24	5.43	1.16	2.50 < .05

Disucussion :

The above table indicated that the 9th class and 10th class students of Hindu have obtained mean and S. D. as 37.73 and 4.47 and 41.53 and 4.34 respectively. The 'CR' value was found to be 10.00 which is higher than the value 2.58, hence significant at .01 level. This has inferred that there is significant difference between the two groups of students. The 10th class students of Hindu have higher scientific temper than the 9th class studetns of Hindu.

Dimension I- Value Perspective :

The table indicated that the mean and S. D. of 9th class and

10th class students of Hindu are 21.31 and 2.98 and 23.48 and 3.16 respectively. The 'CR' value was found to be 10.33 which is higher than the value 2.58, hence significant at .01 level. This difference indicated that the 10th class students of Hindu possess better scientific temper than the 9th class students concerning value perspective.

Dimension II- Aversion to Superstitions :

The table indicated that the mean and S. D. of 9th class and 10th class students of Hindu are 7.54 and 1.47 and 7.85 and 1.38 respectively. The 'CR' value was found to be 2.58 which is equivalent to the value 2.58, hence significant at .01 level. This difference has inferred that the 10th class students are higher than 9th class students in scientific temper concerning aversion to superstitions.

Dimension III- A Set of Attitudes :

The table shows that the mean and S. D. of 9th and 10th class students of Hindu are 3.81 and 1.17 and 3.68 and 1.21 respectively. The 'CR' value was found to be 1.18, which is less than the value 1.96 at .05 significant level. This has inferred that there is no significant difference between 9th and 10th class students of Hindu in scientific temper concerning a set of attitudes.

Dimension IV - A World View Perspective :

The above table indicated that the mean and S. D. of 9th class and 10th class students of Hindu are 5.18 and 1.24 and 5.43 and 1.16 respectively. The 'CR' value was found to be 2.50 which is higher than

the value 1.96 at .05 significant level. This difference has inferred that the 10th class students of Hindu have higher scientific temper than the 9th class students concerning a world view perspective.

5.17 Responses of 9th and 10th class students of Muslim on Scientific Temper Scale

TABLE 5.16

MEAN, S. D. AND CRITICAL RATIO OF 9TH AND 10TH CLASS STUDENTS OF MUSLIM ON SCIENTIFIC TEMPER SCALE AND ITS DIMENSIONS

Scientific Temper Scale	9th class Muslim Students (N=250) Mean	S. D.	10th class Muslim Students (N=150) Mean	S. D.	Critical Ratio	
Total Score	34.92	5.87	37.91	5.49	5.16	< .01
Dimensions :						
I- Value Perspective	19.06	2.99	21.14	3.32	6.30	< .01
II-Aversion to Superstitions	6.69	2.19	7.98	2.11	5.86	< .01
III- A Set of Attitudes	4.86	1.67	4.98	1.23	0.80	> .05
IV- A World View Perspective	4.65	1.58	4.82	1.37	1.13	> .05

Disucussion :

The table indicated that the 9th class and 10th class students of Muslim have have their mean and S. D. as 34.92 and 5.87 and 37.91 and 5.49 respectively. The 'CR' value was found to be 5.16 which is higher than the value 2.58, hence significant at .01 level. This has inferred that the 10th class students of Muslim are higher in scientific temper than the 9th class studetns of Muslim.

Dimension I- Value Perspective :

The table indicated that the mean and S. D. of 9th class and 10th class students of Muslim are 19.06 and 2.99 and 21.14 and 3.32 respectively. The 'CR' value was found to be 6.30 which is higher than the value 2.58, hence significant at .01 level. This significant difference has inferred that the 10th class students of Muslim students have higher scientific temper than the 9th class muslim students concerning value perspective.

Dimension II- Aversion to Superstitions :

The table indicated that the mean and S. D. of 9th class and 10th class students of Muslim are 6.69 and 2.19 and 7.98 and 2.11 respectively. The 'CR' value was found to be 5.86 which is higher that the value 2.58, hence significant at .01 level. This has inferred that the 10th class students of Muslim have higher scientific temper than the 9th class students concerning aversion to superstitions.

Dimension III- A Set of Attitudes :

The table indicated that the mean and S. D. of 9th class and 10th class students of Muslim are 4.86 and 1.67 and 4.98 and 1.23 respectively. The 'CR' value was found to be 0.80 which is less than the value 1.96, hence not significant at .05 level. This has inferred that there is no significant difference between the Muslim students of 9th class and 10th class on scientific temper scale concerning a set of attitudes.

Dimension IV - A World View Perspective :

The table indicated that the mean and S. D. of 9th class and 10th class students of Muslim are 4.65 and 1.58 and 4.82 and 1.37 respectively. The 'CR' value was found to be 1.13 which is less than the 1.96, hence not significant at .05 level. This has inferred that there is no significant difference between 9th class and 10th class Muslim students in scientific temper concerning a world view perspective.

5.18 Responses of Male Students and Female students of Hindu on Scientific Temper Scale

TABLE 5.17

MEAN, S. D. AND CRITICAL RATIO OF MALE STUDENTS AND FEMALE STUDENTS OF HINDU ON SCIENTIFIC TEMPER SCALE AND ITS DIMENSIONS

Scientific Temper Scale	Male Hindu Students (N=367)		Female Hindu Students (N=233)		Critical	
	Mean	S. D.	Mean	S. D.		
Total Score	39.43	5.35	39.47	5.46	0.09	< .05
Dimensions :						
I- Value Perspective	21.64	3.24	21.86	3.18	0.81	> .05
II-Aversion to Superstitions	7.86	1.89	7.57	1.91	1.81	> .05
III- A Set of Attitudes	4.27	1.34	4.31	1.31	0.36	> .05
IV- A World View Perspective	5.24	1.46	5.78	1.36	4.50	< .01

Disucussion :

The table indicated that the mean and S. D. of male students

and female students of Hindu were found to be 39.43 and 5.35 and 39.47 and 5.46 respectively. The 'CR' value was found to be 0.09 which is less than 1.96, hence not significant at .05 level. This has inferred that there is no significant difference between the male and the female students of Hindu in scientific temper.

Dimension I- Value Perspective :

The table has indicated that the male and female students of Hindu have mean and S. D. as 21.64 and 3.24 and 21.86 and 3.18 respectively. The 'CR' value was 0.81 which is less than 1.96, hence not significant at .05 level. This has indicated that there is no significant difference between the Hindu male students and Hindu female students in scientific temper concerning value perspective.

Dimension II- Aversion to Superstitions :

The table indicated that the mean and S. D. of male and female students of Hindu have found to be 7.86 and 1.89 and 7.57 and 1.91 respectively. The 'CR' value was found to be 1.81 which is less than 1.90, hence not significant at .05 level. This has indicated that there is no significant difference between Hindu male students and Hindu female students in scientific temper concerning aversion to superstitions.

Dimension III- A Set of Attitudes :

The above table showed that the male students and female students of Hindu have obtained mean and S. D. as 4.27 and 1.34 and

4.31 and 1.31 respectively. The 'CR' value was found to be 0.36 which is less than 1.96, hence not significant at .05 level. This significant difference has inferred that there is no significant difference between the male and female Hindu in scientific temper concerning a set of attitudes.

Dimension IV - A World View Perspective :

The above table indicated that the male students and female students of Hindu have obtained mean and S. D. 5.24 and 1.46 and 5.78 and 1.36 respectively. The 'CR' value was found to be 4.50 which is higher than the value 2.58, hence significant at .01 level. This significant difference has inferred that the female students of Hindu have higher scientific temper than the male students of concerning a world view perspective.

Contd....

5.19 Responses of Male and Female Students of Muslim on Scientific Temper Scale

TABLE 5.18

MEAN, S. D. AND CRITICAL RATIO OF MALE AND FEMALE STUDENTS OF MUSLIM ON SCIENTIFIC TEMPER SCALE AND ITS DIMENSIONS

Scientific Temper Scale	Male Muslim Students (N=233) Mean	S. D.	Female Muslim Students (N=167) Mean	S. D.	Critical Ratio	
Total Score	36.52	6.25	36.73	6.72	0.32	> .05
Dimensions :						
I- Value Perspective	20.97	3.87	20.98	3.99	0.03	> .05
II-Aversion to Superstitions	7.76	2.14	7.37	2.03	1.86	> .05
III- A Set of Attitudes	4.91	1.43	4.98	1.35	0.50	> .05
IV- A World View Perspective	4.94	1.68	5.29	1.78	1.94	> .05

Disucussion :

The table indicated that the mean and S. D. of male students and female students of Muslim were found to be 36.52 and 6.25 and 36.73 and 6.72 respectively. The 'CR' value was found to be 0.32, which is less than the value 1.96, hence not significant at .05 level. This has inferred that there is no significant difference between the male students and female students of Muslim in scientific temper.

Dimension I- Value Perspective :

The table indicated that the mean and S. D. of male and female

students of Muslim were found to be 20.97 and 3.87 and 20.98 and 3.99 respectively. The 'CR' value was found to be 0.03, which is less than the value 1.96, hence not significant at .05 level. This has inferred that there is no significant difference between the male and female students of Muslim in scientific temper concerning Value perspective.

Dimension II- Aversion to Superstitions :

The table has indicated that the mean and S. D. of male and female students of Muslim were found to be 7.76 and 2.14 and 7.37 and 2.03 respectively. The 'CR' value was found to be 1.86 which is less than the value 1.96, hence not significant at .05 level. This has inferred that there is no significant difference between the male students of Muslim in scientific temper concerning aversion to superstitions.

Dimension III- A Set of Attitudes :

The table indicated that the mean and S. D. of male and female students of Muslim were found to be 4.91 and 1.43 and 4.98 and 1.35 respectively. The 'CR' value was found to be 0.50 which is less than the value 1.96, hence not significant at .05 level. This has inferred that there is no significant difference between the male and female studetns of Muslim in scientific temper scale on a set of attitudes.

Dimension IV - A World View Perspective :

The table indicated that the mean and S. D. male and female Muslim students were found to be 4.94 and 1.68 and 5.29 and 1.78

respectively. The 'CR' value was found to be 1.94, which is less than the value 1.96, hence significant at .05 level. This has inferred that there is significant difference between the male and female students of Muslim in scientific temper scale on a world view perspective. The Muslim female students have more world view perspective concerning scientific temper scale.

5.20 Responses of Rural Students and Urban Students of Hindu on Scientific Temper Scale

TABLE 5.19

MEAN, S. D. AND CRITICAL RATIO OF RURAL STUDENTS AND URBAN STUDENTS OF HINDU ON SCIENTIFIC TEMPER SCALE AND ITS DIMENSIONS

Scientific temper Scale	Rural Hindu Students (N=117) Mean	S. D.	Urban Hindu Students (N=483) Mean	S. D.	Critical Ratio	
Total Score	33.49	5.47	39.62	4.93	11.14	<.01
Dimensions :						
I- Value Perspective	18.85	3.44	22.21	2.89	9.88	< .01
II-Aversion to Superstitions	6.89	2.14	7.72	1.71	3.95	< .01
III- A Set of Attitudes	4.23	1.27	4.55	1.24	2.46	< .05
IV- A World View Perspective	4.93	1.62	5.92	1.35	6.19	< .01

Disucussion :

The table indicated that the rural students and urban students of Hindu have their mean and S. D. as 33.49 and 5.47 and 39.62 and

4.93 respectively. The 'CR' value was found to be 11.14 which is higher than the value 2.58, hence not significant at .01 level. This significant difference has inferred that the Hindu urban students have higher scientific temper than the Hindu rural students.

Dimension I- Value Perspective :

The table indicated that the mean and S. D. of the rural students and urban students of Hindu have found to be 18.85 and 3.44 and 22.21 and 2.89 respectively. The 'CR' value was found to be 9.88 which is less than the value 2.58, significant at .01 level. This significant difference has inferred that the urban students of Hindu have higher scientific temper than the rural students of Hindu on value perspective.

Dimension II- Aversion to Superstitions :

The table has indicated that the mean and S. D. of the rural students and urban students of Hindu were found to be 6.89 and 2.14 and 7.72 and 1.71 respectively. The 'CR' value was found to be 3.95 which is higher than the value 2.58, hence significant at .01 level. This significant difference has inferred that the urban students of Hindu have higher scientific temper than the rural students of Hindu regarding aversion to superstitions.

Dimension III- A Set of Attitudes :

The table indicated that the rural students and urban students of Hindu have their mean and S. D. as 4.23 and 1.27 and 4.55 and 1.24

respectively. The 'CR' value was found to be 2.46 which is higher than the value 1.96, hence significant at .05 level. This significant difference has inferred that the Hindu urban students possess higher scientific temper on a set of attitudes than the Hindu rural students.

Dimension IV - A World View Perspective :

The table indicated that the rural students and urban students of Hindu have their mean and S. D. as 4.93 and 1.62 and 5.92 and 1.35 respectively. The 'CR' value was found to be 6.19 which is higher than the value 2.58, hence significant at .01 level. This significant difference has inferred that the urban students of Hindu have higher scientific temper than the rural students of Hindu regarding a world view perspective.

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5.21 Responses of Rural Students and Urban Students of Muslim on Scientific Temper Scale

TABLE 5.20

MEAN, S. D. AND CRITICAL RATIO OF RURAL STUDENTS AND URBAN STUDENTS OF MUSLIM ON SCIENTIFIC TEMPER SCALE AND ITS DIMENSIONS

Scientific Temper Scale	Rural Muslim Students (N=837) Mean	S. D.	Urban Muslim Students (N=317) Mean	S. D.	Critical Ratio	
Total Score	35.27	6.87	37.98	6.36	3.26	<.01
Dimensions :						
I- Value Perspective	20.34	3.74	20.46	3.58	0.26	> .05
II-Aversion to Superstitions	5.18	2.58	7.24	2.17	6.64	< .01
III- A Set of Attitudes	4.92	1.47	4.83	1.35	0.50	> .05
IV- A World View Perspective	4.48	1.59	5.13	1.57	3.42	< .01

Disucussion :

The above table has indicated that the mean and S. D. of rural students and urban students of Muslim have obtained 35.27 and 6.87 and 37.98 and 6.36 respectively. The 'CR' value was found to be 3.26 which is higher than the value 2.58, hence significant at .01 level. This significant difference has inferred that the urban students of Muslim have higher scientific temper than the rural students of Muslim.

Dimension I- Value Perspective :

The table has indicated that the mean and S. D. of Muslim rural students and urban students are 20.34 and 3.74 and 20.46 and 3.58 respectively. The 'CR' value was found to be 0.26 which is less than the value 1.96, hence not significant at .05 level. This has inferred that there is no significant difference between the rural students and urban students of Muslim on scientific temper scale concerning value perspective.

Dimension II- Aversion to Superstitions :

The table has indicated that the mean and S. D. of the rural students and urban students of Muslim are 5.18 and 2.58 and 7.24 and 2.17 respectively. The 'CR' value was 6.64, which is higher than the value 2.58, hence significant at .01 level. This difference has inferred that there is higher scientific temper among the students of urban area of Muslim regarding aversion to superstitions.

Dimension III- A Set of Attitudes :

The above table has indicated that the mean and S. D. of rural students and urban students of Muslim are 4.92 and 1.47 and 4.83 and 1.35 respectively. The 'CR' value was found to be 0.50 which is less than the value 1.96, hence not significant at .05 level. This has inferred that there is no significant difference between the rural students and urban students of Muslim in scientific temper scale regarding a set of attitudes.

Dimension IV - A World View Perspective :

The above table has indicated that the mean and S. D. of rural students and urban students of Muslim are 4.48 and 1.59 and 5.13 and 1.57 respectively. The 'CR' value was found to be 3.42, which is higher than the value 2.58, hence significant at .01 level. This significant difference has inferred that there is significant difference between the rural students and urban students of Muslim in scientific temper scale concerning a world view perspective.

5.22 Responses of Government School Students and Private School Students of Hindu on Scientific Temper Scale

TABLE 5.21

MEAN, S. D. AND CRITICAL RATIO OF GOVERNMENT SCHOOL STUDENTS AND PRIVATE SCHOOL STUDENTS OF HINDU ON SCIENTIFIC TEMPER SCALE AND ITS DIMENSIONS

Scientific Temper Scale	Government Schools Hindu Students (N=400)		Private Schools Hindu Students (N=200)		Critical Ratio	
	Mean	S. D.	Mean	S. D.		
Total Score	38.39	4.94	40.67	4.29	5.85	<.01
Dimensions :						
I- Value Perspective	20.71	2.78	22.57	2.28	8.86	< .01
II-Aversion to Superstitions	7.79	1.98	8.18	1.47	2.79	< .01
III- A Set of Attitudes	4.15	1.41	4.13	1.43	0.17	> .05
IV- A World View Perspective	4.95	1.49	5.71	1.27	6.33	< .01

Disucussion :

The table has indicated that the Government school students and Private school students of Hindu have their mean and S. D. as 38.39 and 4.94 and 40.67 and 4.29 respectively. The 'CR' value was found to be 5.85 which is higher than the value 2.58, hence significant at .01 level. This has indicated that the Private school Hindu students have higher scientific temper than the Government school Hindu students.

Dimension I- Value Perspective :

The table indicated that the Government school students and Private school students of Hindu have their mean and S. D. as 20.71 and 2.78 and 22.57 and 2.28 respectively. The 'CR' value was found to be 8.86 which is higher than the value 2.58, hence significant at .01 level. This significant difference has inferred that the private school students of Hindu have higher scientific temper on value perspective than the Government school students.

Dimension II- Aversion to Superstitions :

The table indicated that the students of Government school and private school students of Hindu have their mean and S. D. as 7.79 and 1.98 and 8.18 and 1.47 respectively. The 'CR' value was 2.79 which is higher than the value 2.58, hence significant at .01 level. This significant difference has inferred that the private school students of Hindu have higher scientific temper than the Government school concerning aversion to superstitions.

Dimension III- A Set of Attitudes :

The table shows that the mean and S. D. of Government school students and private school students of Hindu were found to be 4.15 and 1.41 and 4.13 and 1.43 respectively. The 'CR' value was found to be 0.17 which is less than the value 1.96, hence not significant at .05 level. This has inferred that there is no significant difference between the Government school students and private school students of Hindu in scientific temper scale on a set of attitudes

Dimension IV - A World View Perspective :

The table shows that the mean and S. D. of Government school students and private school students of Hindu were found to be 4.95 and 1.49 and 5.71 and 1.27 respectively. The 'CR' value was found to be 6.33 which is higher than the value 2.58, hence significant at .01 level. This significant difference has inferred that the private school students of Hindu have higher scientific temper than the Government school students of Hindu concerning a world view perspective.

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5.23 Responses of Government School Students and Private School Students of Muslim on Scientific Temper Scale

TABLE 5.22

MEAN, S. D. AND CRITICAL RATIO OF GOVERNMENT SCHOOL STUDENTS AND PRIVATE SCHOOL STUDENTS OF MUSLIM ON SCIENTIFIC TEMPER SCALE AND ITS DIMENSIONS

Scientific Temper Scale	Government Schools Muslim Students (N=350)		Private Schools Muslim Students (N=50)		Critical Ratio	
	Mean	S. D.	Mean	S. D.		
Total Score	38.47	5.96	40.42	4.73	2.64	<.01
Dimensions:						
I- Value Perspective	20.92	3.73	22.08	2.74	2.64	< .01
II-Aversion to Superstitions	6.98	2.36	8.81	2.13	5.55	< .01
III- A Set of Attitudes	5.12	1.53	5.26	1.41	0.64	> .05
IV- A World View Perspective	4.88	1.72	4.99	1.86	0.39	> .05

Disucussion :

The table has indicated that the Government school students and private school students of Muslim have obtained their mean and S. D. as 38.47 and 5.96 and 40.42 and 4.73 respectively on scientific temper scale. The 'CR' value was found to be 2.64 which is higher than the value 2.58, hence significant at .01 level. This significant difference has inferred that the private school students of Muslim have higher scientific temper than the Government school students.

Dimension I- Value Perspective :

The table indicated that the Government school students of Muslim have obtained their mean and S. D. as 20.92 and 3.73 and 22.08 and 2.74 respectively. The 'CR' value was found to be 2.64, which is higher than the value 2.58, hence significant at .01 level. This has inferred that the private school students of Muslim have higher scientific temper than the Government school students regarding Value Perspective.

Dimension II- Aversion to Superstitions :

The table indicated that the Government school students and private school students of Muslim have obtained their mean and S. D. as 6.98 and 2.36 and 8.81 and 2.13 respectively. The 'CR' value was found to be 5.55 which is higher than the value 2.58, hence significant at .01 level. This has inferred that the private school students of Muslim have higher scientific temper than the Government school students in aversion to superstitions.

Dimension III- A Set of Attitudes :

The table has indicated that the mean and S. D. of Government school Muslim students and Private school Muslim students were found to be 5.12 and 1.53 and 5.26 and 1.41 respectively. The 'CR' value has found to be 0.64 which is less than the value 1.96, hence not significant at .05 level. This significant difference has inferred that there is no

significant difference between the Government school Muslim students and private school Muslim students in scientific temper scale on a set of attitudes.

Dimension IV - A World View Perspective :

The table has indicated that the mean and S. D. of Government school Muslim students and private school Muslim students were found to be 4.88 and 1.72 and 4.99 and 1.86 respectively in scientific temper scale. The 'CR' value was found to be 0.39 which is less than the value 1.96, hence not significant at .05 level. This difference has inferred that there is no significant difference between the Muslim students of Government school and private school in the scientific temper scale concerning a world view perspective.

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CHAPTER VI

RELATIONSHIP BETWEEN UNDERSTANDING OF SCIENCE AND SCIENTIFIC TEMPER

6.1 Introduction

A crucial analysis of the science education programmes clearly indicate that there is a relationship between conceptual understanding of science and scientific temper, provided appropriate teaching -learning interactions are made available to students. In such learning environments students try to search answers of questions and science teachers function as facilators of learning. It has been accepted that Affective Domains of science education should be given priority because survival of a democratic society needs people with scientific thinking, and scientific thought to make rational, independent and meaningful decisions on socio - scientific issues. Most of the developing countries are facing problems, such as, population explosion, environment degradation and illiteracy.

Therefore, all peopie need education in science to acquire awareness about their environment and other problems which can be solved through rational and objective decisions.

In this study, the investigator has taken two aspects of science education which are meaningful in developing understanding of science and scientific temper. When ever a researcher in Education desires to

measure some quality in a group or individual, he has to face the problem of choosing the best instrument for this purpose. He has to choose suitable tests which satisfies his needs by some absolute standards.

There are many specific considerations entering into the evaluation of a test. One such purpose may be obtained by seeing the relationship of understanding of science and Scientific Temper. A person who has understanding of science will react objectively to related scientific problems. Similarly, if a person has positive or favourable scientific temper he will react positively to the related scientific knowledge or information or problems, is approved by commonsense and sanctioned by reasons. If the thesis implicit in the above observation is accepted then there should be significant relationship between understanding of science and scientific temper. What is the position in this study ? The following data provides an answer to this question.

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TABLE 6.1

COEFFICIENT OF CORRELATION OF TOTAL SAMPLE OF STUDENTS (N=1000)

Understanding of Science Scale / Scientific Temper Scale	Total Score	I Concepts of Science	II Science Policy Perspective	III Science Value Perspective
Total Score	0.38	0.32	0.37	0.13
I- Value Perspective	0.31	0.27	0.27	0.11
II- Aversion to Superstitions	0.27	0.23	0.24	0.09
III- A set of Attitudes	0.07	0.07	0.08	0.00
IV- A World View Perspective	0.29	0.21	0.27	0.12

Discussion :

The above table has revealed that the coefficient of correlation between total scores on understanding of science scale and total scores on scientific temper scale of total sample of students was 0.38. The obtained coefficient of correlation is significant at .01 and .05 level of significance. Hence, there is significant relationship between understanding of science and scientific temper. Therefore, the hypothesis No. 13 of present research failed to be retained which states 'There is no significant relationship between scores on understanding of science and scores on scientific temper of total sample of students.

The above table further reveals that the first dimension of understanding of science was concepts of science. The coefficient of correlation between total score on scientific temper and concepts of science is 0.32, which is significant at .01 level of significance. Therefore, it can be concluded that there is significant correlationship between concepts of science and scientific temper.

The coefficient of correlation between total score of scientific temper and science policy perspective- second dimension of understanding of science is 0.37. The calculated coefficient of correlation is significant at .01 and .05 level of significance. Hence, the scores on science policy perspective are significantly correlated with total scores on scientific temper.

The total sample of students have reflected significant correlation coefficient of science value perspective and total scores of scientific temper as 0.13. This correlation coefficient is significant at .01 and .05 level. Therefore, the scientific temper of students is significantly correlated with science value perspective.

The dimensions of scientific temper were value perspective, Aversion to superstitions, a set of attitude towards science and world view perspective. The scores of total sample of students on these dimensions as revealed from Table 6.1 were found to be significantly correlated with total scores on understanding of science scale and its dimensions. Thus, the hypothesis No. 13 failed to be ratained for dimensions of scientific temper scale and dimensions of understanding of science scale.

Further, the science value perspective dimension of understanding of science was not found to be significantly correlated with a set of attitude towards science dimension of scientific temper.

TABLE 6.2

COEFFICIENT OF CORRELATION OF TOTAL SAMPLE OF HINDU STUDENTS (N=1000)

Scientific Temper Scale \ Understanding of Science Scale	Total Score	I Concepts of Science	II Science Policy Perspective	III Science Value Perspective
Total Score	0.46	0.40	0.40	0.17
I- Value Perspective	0.40	0.36	0.33	0.15
II- Aversion to Superstitions	0.23	0.21	0.20	0.07
III- A set of Attitudes	0.14	0.10	0.16	0.07
IV- A World View Perspective	0.32	0.23	0.28	0.14

Discussion :

In the present research work there were Hindu students (N=600). The calculated coefficient of correlation between scores on scientific temper and its dimensions and understanding of science and its dimensions are tabulated in Table 6.2. The table reveals significant coefficient of correlation between total scores on scientific temper scale and understanding of science scale and its dimensions. All the four dimensions of scientific temper scale were found to be significantly

correlated with total scores on understanding of science, concepts of Science and Science policy perspective. The total scores on science value perspective dimension of understanding of science was not found to be significantly correlated with aversion to superstition and a set of attitude towards science dimension of scientific temper. Therefore, the hypothesis No. 13 of present study has been ratained in respect of above coefficient of correlation, as related to value perspective.

There were total 400 Muslim students. The coefficient of correlation between understanding of science scale and scientific temper scale were calculated and tabulated in following Table 6.3.

TABLE 6.3

COEFFICIENT OF CORRELATION OF TOTAL SAMPLE OF MUSLIM STUDENTS (N=400)

Scientific Temper Scale \ Understanding of Science Scale	Total Score	I Concepts of Science	II Science Policy Persp-ective	III Science Value Persp-ective
Total Score	0.30	0.26	0.27	0.07
I- Value Perspective	0.23	0.19	0.22	0.07
II- Aversion to Superstitions	0.10	0.24	0.13	-0.01
III- A set of Attitudes	0.27	0.07	0.23	0.09
IV- A World View Perspective	0.20	0.19	0.16	0.04

Discussion :

The above table revealed that the total scores on scientific temper are significantly correlated with total scores on understanding of science, concepts of science and science policy perspective dimensions. Therefore, this significant correlation coefficient of Muslim students failed to select the hypothesis No. 13 of present research work.

All the four dimension of scientific temper scale are significantly correlated with total scores on understanding of science scale and science policy perspective dimension.

As evident from table 6.3 the scores on science value perspective dimension of understanding of science scale is not significantly correlated with total scores and scores on dimension of scientific temper scale.

6.2 Effect of Class Level on Relationship of Understanding of Science with Scientific Temper

Out of total sample of 1000 students there were 660 students from 9th class and 340 students from 10th class. To determine the effect of class level on relationship of understanding of science and its dimensions with scientific temper and its dimensions coefficient of correlations were calculated and tabulated in Table 6.4 and 6.5.

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TABLE 6.4

COEFFICIENT OF CORRELATION OF TOTAL 9th CLASS STUDENTS (N=660)

Scientific Temper Scale \ Understanding of Science Scale	Total Score	I Concepts of Science	II Science Policy Perspective	III Science Value Perspective
Total Score	0.38	0.30	0.37	0.11
I- Value Perspective	0.32	0.26	0.30	0.09
II- Aversion to Superstitions	0.23	0.18	0.24	0.05
III- A set of Attitudes	0.06	0.05	0.09	-0.01
IV- A World View Perspective	0.29	0.19	0.26	0.13

Discussion :

The above table has revealed that coefficient of correlation between scientific temper and with understanding of science and its dimensions are 0.38, 0.30, 0.37 and 0.11. All these calculated coefficient of correlation are positive and significant at .01 and .05 level of significance. The coefficient of correlation of value perspective dimension and world view perspective dimensions are positive and significantly correlated with total scores on understanding of science and its dimensions of 9th class students.

As evident from table 6.4 the dimension - a set of attitude towards science of scientific temper is not significantly correlated with total scores on understanding of science and its dimensions.

The science value perspective dimension of understanding of science is significantly correlated with value perspective and world view perspective dimension of scientific temper and the same is not significantly correlated with aversion to superstition dimension of scientific temper in the group of 9th class students.

TABLE 6.5

COEFFICIENT OF CORRELATION OF TOTAL 10th CLASS STUDENTS (N=340)

Understanding of Science Scale / Scientific Temper Scale	Total Score	I Concepts of Science	II Science Policy Perspective	III Science Value Perspective
Total Score	0.37	0.33	0.31	0.18
I- Value Perspective	0.28	0.25	0.22	0.14
II- Aversion to Superstitions	0.33	0.30	0.26	0.18
III- A set of Attitudes	0.07	0.07	0.07	0.01
IV- A World View Perspective	0.29	0.22	0.30	0.10

Discussion :

The above table 6.5 revealed that coefficient of correlation between total scores on scientific temper, value perspective dimension and aversion to superstition with understanding of science and its dimensions are positive and significant at .01 and .05 level in the group of 10th class students. The dimension - world view perspective of scientific

temper was significantly correlated with total scores, concepts of science dimension and science policy perspective dimension of public understanding of science.

The table further reveals that the dimension a set of attitude towards science is not significantly correlated with total scores on understanding of science and its dimensions, all the coefficients are positive and fails to be significant at .01 and .05 level of significance. Thus the group 9th class students and 10th class students yielded significantly coefficient of correlation of understanding of science and scientific temper. Therefore, the hypothesis No. 14 of present study failed to be retained which states as 'there is no significant effect of class level of students on relationship of public understanding of science with scientific temper.

6.3 Effect of Sex on Relationship of Understanding of Science with Scientific Temper

In the present research work out of 1000 students there were 650 male students and 350 female students. To find out the effect of sex on relationship of understanding of science with scientific temper correlation coefficient of male students and female students were calculated and tabulated in table 6.6 and 6.7.

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TABLE 6.6

COEFFICIENT OF CORRELATION OF TOTAL MALE STUDENTS (N=650)

Scientific Temper Scale \ Understanding of Science Scale	Total Score	I Concepts of Science	II Science Policy Perspective	III Science Value Perspective
Total Score	0.34	0.28	0.32	0.09
I- Value Perspective	0.26	0.21	0.24	0.07
II- Aversion to Superstitions	0.24	0.20	0.21	0.08
III- A set of Attitudes	0.07	0.07	0.08	0.02
IV- A World View Perspective	0.26	0.18	0.25	0.10

Discussion :

As evident from table 6.6 the total scores on understanding of science of male students (N=650) are significantly and positively correlated with total scores on scientific temper scale and world view perspective dimension. The value perspective dimension and aversion to superstition dimension of scientific temper are positively and significantly correlated with total scores on understanding of science and scores on concepts of science and science policy perspective dimension in the group of male students. The relationship of above dimension of scientific temper scale is positive but not significant with science value perspective dimension of understanding of science.

The total male students yielded positive and not significant coefficient of correlation of a set of attitude towards science with total scores on understanding of science and its dimension. Thus, there is no effect of male students on relationship of understanding of science and its dimensions with scores on scientific temper and its dimensions.

TABLE 6.7

COEFFICIENT OF CORRELATION OF TOTAL FEMALE STUDENTS (N=350)

Scientific Temper Scale / Understanding of Science Scale	Total Score	I Concepts of Science	II Science Policy Persp-ective	III Science Value Persp-ective
Total Score	0.44	0.40	0.36	0.20
I- Value Perspective	0.40	0.39	0.31	0.18
II- Aversion to Superstitions	0.32	0.29	0.30	0.13
III- A set of Attitudes	0.07	0.05	0.07	0.06
IV- A World View Perspective	0.35	0.27	0.31	0.16

Discussion :

The total female students (N=350) yielded positive and significant coefficient of correlation of understanding of science and its dimensions with total scores on scientific temper and scores on value perspective, aversion to superstitions and a world view perspective dimensions.

The relationship of 'a set of attitude towards science' dimension of scientific temper with total scores on understanding of science and scores on its dimensions was positive but not significant at .01 and .05 level of significance in the group of female students. Hence, the positive and significant coefficients of correlation in the group of female students failed to retain the hypothesis No. 14 of present research work which states as 'There is no significant effect of sex on relationship of understanding of science with scientific temper and dimensions. Further, the above hypothesis is not selected in the group of male students.

6.4 Effect of Geographical Location of Students on Relationship of Understanding of Science with Scientific Temper

There were 200 rural students and 800 urban students in the present research work. The coefficient of correlation of understanding of science and its dimensions with scientific temper and its dimensions of rural students and urban students were calculated in order to visualise the effect of geographical location of students on above coefficient of correlations. The calculated coefficient correlations with their respective level of significance are tabulated in table 6.8 and 6.9.

Contd.....

TABLE 6.8

COEFFICIENT OF CORRELATION OF TOTAL RURAL STUDENTS (N=200)

Understanding of Science Scale / Scientific Temper Scale	Total Score	I Concepts of Science	II Science Policy Persp-ective	III Science Value Persp-ective
Total Score	0.05	-0.03	0.15	-0.03
I- Value Perspective	0.01	-0.04	0.07	-0.01
II- Aversion to Superstitions	0.06	-0.12	0.03	-0.06
III- A set of Attitudes	0.07	0.06	0.12	-0.06
IV- A World View Perspective	0.14	0.05	0.21	0.03

Discussion :

From the above table it is evident that all the coefficient of correlation of rural students are weak and less than the value at .01 and .05 level of significance for total scores of understanding of science and scientific temper and their dimensions. Only one coefficient of correlation is significant at .01 level that is relationship of Science Policy Perspective with a World View Perspective dimensions. Hence the group of rural students have reflected the effect of geographical location on relationship of understanding of science and its dimensions with scientific temper and its dimensions. The total sample of students showed significant positive relationship of understanding of science with scientific temper.

TABLE 6.9

COEFFICIENT OF CORRELATION OF TOTAL URBAN STUDENTS (N=800)

Understanding of Science Scale / Scientific Temper Scale	Total Score	I Concepts of Science	II Science Policy Perspective	III Science Value Perspective
Total Score	0.40	0.35	0.33	0.15
I- Value Perspective	0.33	0.30	0.27	0.12
II- Aversion to Superstitions	0.29	0.25	0.24	0.12
III- A set of Attitudes	0.06	0.05	0.06	0.01
IV- A World View Perspective	0.28	0.20	0.25	0.13

Discussion :

The table 6.9 reveals that in the group of urban students (N=800) the calculated coefficients of correlations are positive and significant for total scores on scientific temper and total scores on understanding of science and its dimensions. The relationship of value perspective, aversion to superstition and a world view perspective dimension of scientific temper with understanding of science and its dimension is positive and significant.

A set of attitude towards science dimension of scientific temper is not significantly correlated with total scores on understanding of science and scores on its dimensions viz Concepts of Science, Science Policy Perspective and Science Value Perspective.

The rural students failed to reflect significant relationship of understanding of science with scientific temper while urban students reflected positive and significant relationship of understanding of science with scientific temper. Therefore, the hypothesis No. 14 of present research has been retained which states as 'There is no significant effect of geographical location of students on relationship of understanding of science and its dimensions with scientific temper and its dimensions.

6.5 Effect of Type of School on Relationship of Understanding of Science with Scientific Temper

The total sample of 1000 students was from government schools and private schools. There were 750 students from government schools and 250 students from private schools. The coeeficient of correlations of understanding of science with scientific temper of students from government schools and students from private schools were calculated in order to visualise the effect of type of school of students. The calculated coefficient of correlation are tabulated in Table 6.10 and 6.11.

Contd.....

TABLE 6.10

COEFFICIENT OF CORRELATION OF TOTAL STUDENTS FROM GOVERNMENT SCHOOL (N=750)

Scientific Temper Scale \ Understanding of Science Scale	Total Score	I Concepts of Science	II Science Policy Persp-ective	III Science Value Persp-ective
Total Score	0.34	0.29	0.31	0.11
I- Value Perspective	0.26	0.23	0.22	0.09
II- Aversion to Superstitions	0.21	0.19	0.19	0.07
III- A set of Attitudes	0.14	0.12	0.15	0.03
IV- A World View Perspective	0.26	0.19	0.24	0.11

Discussion :

The table reveals that the coefficient of correlation of scientific temper and its dimensions with total scores on understanding of science and scores on concepts of science, science value perspective are positive and significant at .01 and .05 level of significance. Thus, in the group of students from Government schools the relationship of scientific temper and its dimension with total scores on understanding of science and its dimensions - concepts of science and science policy perspective, has been positive.

The science value persective dimension of understanding of science is not significantly correlated with aversion to superstition and a set of attitude towards science as calculated coefficients at .01 and .05 level of significance in the group of students from government schools.

TABLE 6.11

COEFFICIENT OF CORRELATION OF TOTAL STUDENTS FROM PRIVATE SCHOOLS (N=250)

Scientific Temper Scale / Understanding of Science Scale	Total Score	I Concepts of Science	II Science Policy Perspective	III Science Value Perspective
Total Score	0.24	0.23	0.16	0.07
I- Value Perspective	0.18	0.18	0.12	0.04
II- Aversion to Superstitions	0.19	0.16	0.14	0.08
III- A set of Attitudes	-0.02	-0.01	-0.02	-0.03
IV- A World View Perspective	0.22	0.13	0.21	0.10

Discussion :

The table 6.11 reveals that the scores scientific temper and scores on a world view perspective dimension, aversion to superstition dimension are significantly correlated with total scores on understanding of science and scores on concepts of science ans science policy perspective in the group of students of private schools.

In the above group of students the relationship of value perspective and aversion to superstition is significant with total scores on understanding of science and concepts of science dimensions. Therefore, the hypothesis No. 14 is being retained as there is no effect of type of school of students on relationship of understanding of science with scientific temper. The same hypothesis is failed to retained in respect

of not significant relationship of scores on science value perspective dimension with total scores on scientific temper and scores on its dimension in the group of students from private schools, on all the group of students from private schools on all the group of students from government schools the relationship was significant for total scores on scientific temper and scores on value perspective and a world view perspective dimensions. Thus the type of school have got significant effect on relationship of public understanding of science and scientific temper.

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CHAPTER VII

OVERVIEW, FINDINGS, EDUCATIONAL IMPLICATIONS AND PERSPECTIVES FOR FUTURE RESEARCH

7.1 Introduction

Through out history, intellectual, social, scientific, cultural and technological events at times, accumulated to produce a major turning point in human affairs. The introduction of agriculture, the industrial revolution, the use of comuters, automation, bio-technology and genetic engineering, the revolution in information technology, the acceptance of mechanised farming and the use of satellites for weather forecasting mark such times. Again we find human beings challenged with a plethora of circumstances, events, and innovations in socio-scientific and socio-technical systems assures us that our future will not be lke our past, no matter how we deal with them.

John Desmond wrote his book *The Social Function of Science* in the late 1930s intended to show that he proper relationship between science and society depended on the welfare of both. After seventy six years of the publication of that book it appears that the contemporary 'scientific and technological revolution' has been a part of what Bernard perceived. Today, there are two large fields of tasks, with the help of which the science of science particularly contribute effectively, to

influence the prospects of scientific progress : (i) Research in the scientific method and dynamic of science theories, and (ii) investigations of historic, organisational, economic, social, psychological and other aspects of scientific activity, with increasing attention being paid to ethical problems of science and social responsibility of scientists in our time, in particular their specific responsibility for the application of scientific research findings for exclusively human aims (Krober, 1991).

The scientific findings which are translated today, into general social practice, are, as a rule, results of relatively recent research, which are, moreover of a fundamental character, for example in the case of biotechnology or of the information and communication technologies. These scientific findings differ fundamentally from the educational level, society has attained so far. Thus, a wide range of professional groups and social strata is immediately confronted with the new science, new scientific values and totally different social responsibilities. Thomas Kuhn in the *Structure of Scientific Revolutions* (1970) has very aptly mentioned that through experimental and socio-cultural impacts new paradigm emerges and it leaves behind the old paradigm. Capra (1983) has observed that Descartes vision and Cartesian view of science has changed. The acceptance of the Cartesian view as absolute truth and Descartes' method as the only valid way to knowledge, has played and important role in bringing about current cultural imbalance. Cartesian view is linear, focused and analytic. This approach is likely to generate self centered activity. Today, there is a need of holistic view. The new vision of reality

is an ecological view in a sense which goes beyond the immediate concerns with environmental protection. This will prove meaningful only if it goes hand in hand with profound changes in values, beliefs and ethics.

A Conceptual and Empirical View of Understanding of Science and Scientific Temper

It is apparent that we get conceptual and functional aspects of understanding of Science and Scientific Temper. In this study the investigator has taken following meaning : Understanding of science is related to the preliminary knowledge of science concepts, science policy perspective and world view.

Scientific temper is a process of thinking to act objectively and rationally based upon available evidence at the time of making decision. Scientific temper is a state of mind, comprising, thoughts, action and conduct of an individual in a specific situation.

P. N. Huskar (1989) has observed that scientific methods and science itself are products of scientific temper. It represents ethos of science which encourages rationality, objectivity and intutive wisdom.

India has accepted Science as an integrated part of School Curricula. National Policy on Education 1986 (1992) has highlighted the need and inculcation of scientific temper through formal education. Similarly, A Study Report from Research Centre for Educational Innovation and Development, Tribhuvan University (1990) has observed 'Science education at school has to be given a new drive, a new direction. But this kind of innovative measure can come up effective only if the

school science curriculum aims to develop in the students scientific attitudes towards things in real life situations and simple specialised skills in observing the everyday phenomena as they occur around them.

Thus, India has accepted the development of understanding of science and scientific temper among students through formal education. In addition to it there are some Non Government Organisations actively engaged in developing scientific literacy. Media has also started meaningful programmes namely 'Turning Point' and 'Living on the Edge' to inculcate awareness of science and science related issues.

Conceptually, different meaningful efforts have been initiated. But empirical evidence appears to be sparse. The investigator could not locate any published study on the Public Understanding of Science. However, investigator could locate three studies, Mathur (1990), Sood (1992) and Kansakar (1996), on the Public Understanding of Science. Similarly, there was only one published study on Scientific Temper (Singh, 1990). However three other studies, Sharma (1991), Dubey, K. K. (1992) and Leela Pradhan (kansakar) 1996, on Scientific Temper have also found. It is clear that there is an urgent need of assessment of understanding of science and scientific temper.

The situation is not very encouraging in developed countries too. There are limited studies in these areas but ample work has been done on scientific attitude. In Biritain Lucas (1983), Miller (1983) and others have attempted some studies which are very limited.

As the Royal Society's report noted, whilst survey of public

attitudes to science have been plentiful, especially in the U. S. A., detailed investigations into the scientific knowledge which adults possess are sparse. Indeed a recommendation of the Royal Society's report was that 'research into ways of measuring public understanding of science and technology and of assessing the effects of improved understanding should be sponsored by research funding agencies (1985, p. 12).

Therefore, the investigator has studied this problem.

There is a need to study another aspect of the understanding of science. Knamiller (1984) has observed that the conventional science education programmes dominate the third world classroom. Al-Hidabi searched for relevant science education in Yemen schools through an examination of policy statements, text book content, classroom teaching and examination papers. He found that there was a very wide gap between the policy making level and the implementation level. There was very little reference to the social as well as national aspects of science relevance in science books and science teaching classrooms.

The explosion at Chernobyl that spread radioactive cloud across the Ukraine and Europe, poisoning crops spawning bizarre mutant like stock and exposing nearly 5 million people to dangerous fall out. How many people understand the devastating environmental implications happend by chernobyl style accidents ? Perhaps very limited people can understand it.

The Bhopal Gas leak tragedy in 1984 was the world's worst

industrial disaster with far reaching consequences, compelled people to think that scientific literacy, understanding of science will help in pieracing the consequences of out actions.

7.2 Statement of the Problem

The investigator has researched the following problem : *"A STUDY OF THE UNDERSTANDIG OF SCIENCE AND SCIENTIFIC TEMPER OF HINDU AND MUSLIM STUDENTS"*

7.3 Objectives of the Study

The study was planned to achieve the following objectives :

1. To determine the levels of understanding of science among Hindu and Muslim students.
2. To study the effect of type of school, class level, geographical locale and sex on levels of understanding of science.
3. To study the levels of scientific temper among the Hindu and Muslim students.
4. To study the effect of type of school, class level, geographical locale and sex on levels of scientific temper.
5. To determine the relationship between levels of scientific temper and understanding of science.

7.4 Hypotheses of the Study

In order to achieve the foregoing objectives, following hypotheses were formulated :

1. Theoretical mean of the total sample is not different than the obtained mean on the understanding of science scale.

2. Students from Hindu & Muslim religion are not different on the understanding of science scale and its dimesions.
3. Students of different groups are not different on scores of understanding of science scale and its dimensions due to class level differences.
4. Students of different classes are not different on the scores of the understanding of science scale and its dimensions.
5. Students from urban and rural schools are not different on the scores of the understanding of science scale and its dimensions.
6. Students from different types of school are not different on the scores of the understanding of science scale and its dimensions.
7. Theoretical mean of the total sample is not different than the obtained mean on the scientific temper scale.
8. Students from Hindu and Muslim religion are not different on the scientific temper scale and on its dimensions.
9. Students of different groups are not different on scores of scientific temper and its dimensions due to class level differences.
10. Students of different sexes are not different on the scores of scientific temper and its dimensions.
11. Students from urban and rural schools are not different on the scores of scientific temper scale and its dimensions.
12. Students from different types of schools are not different on the scores of the scientific temper scale and its dimensions.

13. There is no significant relationship between scores of scientific temper scale.
14. There is no significant effect of following on coefficient of correlation between scores of understanding of science and scientific temper :

I) Class level of students

II) Geographical location of students

III) Type of school of students

IV) Sex of students

7.5 Reseach Setting : Selection of The Sample

The sample of the study was selected from all the Government and Private secondary schools of Jhansi Region, comprising three District: Jhansi, Orai (Jalaun) and Lalitpur, by random sampling procedure. In other words, this sample is representative of the whole population. In this study students of both the sexes from different geographical locales have been selected randomly. Random selection is a process by which every element in the population has an equal chance of being chosen in the sample and the same was adopted for the present study.

The sample comprises Hindu and Muslim students studying in 9th and 10th classes. The total sample includes 1000 students and its distribution is as follow :

TABLE 3.1

SAMPLE DISTRIBUTION (N = 1000)

Religion		Geographical Locale		Class		Sex	
Hindu	Muslim	Urban	Rural	9th	10th	Male	Female
600	400	800	200	660	340	650	350

Salient Features of the Sample :

The investigator has selected sample in accordance to the need of the study. This study is meant to determine the levels of understanding of science and scientific temper among the students. This sample has following characteristics :

1. Students from two different religious background, namely Hindu and Muslim have been selected.
2. Students from different academic background have been selected.
3. One group of students (class 9th students) have studied science for nine years in school, which is a sufficient period to inclucate scientific temper.
4. This sample comprises both male and female to determine sex bias, if there is any, due to formal education.

7.6 Research Design

There were five independent variables, each has two levels. Therefore, the research design for this study has been factorial design. The five independent variables has been as follows :

1.	Type of Religion	:	Hindu and Muslim
2.	Class level	:	9th and 10th
3.	Type of School	:	Government Schools and Private Schools
4.	Geographical locale	:	Urban and Rural
5.	Sex	:	Male and Female

The dependent variables of the present investigation has been:

1. Understanding of Science and its Dimensions
2. Scientific Temper and its Dimensions

Procedure for Analysis :

Data has been computerised and following calculations were made :

1. Mean and Standard Deviation
2. Critical Ratio test for significant difference between means
3. Coefficient of correlation

With the help of above statistical treatments, inter group comparison and relationships has been tested.

7.7 Instruments

The investigator has adapted two instruments, constructed and validated by Leela Pradhan (Kansakar), 1996. These are :

1. The Understanding of Science Scale
2. Scientific Temper Scale

1. Understanding of Science Scale comprises three dimensions namely,

   I. Concepts of Science

   II. Science Policy perspective

   III. Science Value Perspective

   There are 40 items in this scale of which 20 items deals with Concepts of Science, 15 items Science Policy Perspective and 5 items for Science Value Perspective.

2. The Scientific Temper Scale comprises four dimensions namely :

   I. Value Perspective

   II. Aversion to superstitions

   III. A set of attitudes

   IV. A world view perspective

   There are 30 items of which 16 items deals with Value Perspective, 6 items Aversion to Superstitions, 4 items a set of attitudes and 4 items - A world view perspective.

7.8 Findings Related to Understanding of Science

Investigator has tried to find out the levels of understanding of science among the students of Hindu and Muslim. The findings are as follows :

1. The total sample of students of Hindu and Muslim (N=1000) has favourable understanding of science. It was also inferred that the total sample has favourable understanding of science concepts, science policy perspective. Incidently, understanding

of science among students was not highly favourable on dimension value judgement.

2. It was found that Hindu students (N=600) possess significantly higher understanding of science than the Muslim students (N=400). Hindu students had significantly higher understanding of science concepts, science policy perspective and value judgement dimensions.

3. It was indicated that students from 9th class donot significantly differ from students of 10th calss on their understanding of science and its dimensions accept science concepts, in which 10th class students possess more favourable understanding.

4. Similarly, male and female students do not differ significantly on their understanding of science. But there is significant difference between male and female students on dimensions : science policy and value judgement. The male students possess more understanding on above mentioned dimensions than female students.

5. It was revealed that students from schools situated in urban possess higher understanding of science than the students from schools situated in rural. it is true on the three dimensions of this scale also.

6. It was indicated that the students studying in private schools has higher understanding of science than students from Government schools. It was also revealed that :

(a) The Hindu students from private schools possess higher understanding of science accept dimension III- Value Judgement in which there is no significant difference between Hindu students of Govt. and Private schools.

(b) The Muslim students from private schools were not different from the students of Government schools concerning their understanding of science accept on dimension I- Science Concepts and dimensions III- Value judgement. Where, there is significant difference between Muslim students from Govt. and Private schools. The private school students possess more favourable understanding on these dimensions.

7. There is significant difference between 9th and 10th class students of Hindu in their understanding of science. 10th class students possess higher understanding of science on all the dimension except dimension III- Value Judgement where thre no significant diffenrence between 9th and 10th class Hindu students. But their counterparts that is Muslim were not significantly different in their understanding of science. But there is significant difference on dimensions of understanding of science. The 10th class Muslim students possess favourable science concepts, science policy and value judgement than the 9th class Muslim students.

8. It was indicated that the 9th and 10th class students of Hindu and Muslim differ on their understanding of science and

students of Hindu possess much more favourable understanding of science.

9. It was indicated that male and female students of Hindu and Muslim independently do not differ significantly concerning their understanding of science.
10. It was indicated that male Hindu and Muslim students as well as female Hindu and Muslim students significantly differ in understandng of science. Male and female students of Hindu possess much more favourable understanding of science.
11. It was indicated that the students from urban and rural schools differ in their understanding of science. This is true for the students from both Hindu and Muslim. The students from urban schools possess much higher understanding of science. But students from rural schools of Hindu and Muslim do not differ in their understanding of science. Students from urban schools of Hindu and Muslim differ in their understanding of science. The urban Hindu students possess higher understanding of science.
12. Students from Government schools of Hindu and Muslim differ on their understanding of science. This is also true to students of private schools. Hindu students from Government and Private schools possess higher understanding of science.

7.9 Findings Related to Scientific Temper

The investigator has tried to measure Scientific Temper of the students of Hindu and Muslim. The findings are as follows :

1. The total sample (N=1000) has above average scientific temper. The sample has positive and favourable value perspective, it has aversion to supersitions, favourable attitude towards science and has constructive world view about science and its role in developing a blanced world.
2. It was indicated that the students of Hindu reflect higher level of scientific temper than the students of Muslim. These two groups significantly differ on different dimensions of scientific temper, that is, Value Perspective, Aversion to Superstition, Attitude towards science and a World View Perspective.
3. This study has reflected that 10th class students possess much more favourable scientific temper in comparison to 9th class students. It was also indicated that 10th class students possess higher level of value perspective, attitude towards science and a world view perspective.
4. It was indicated that there is no difference in the level of scientific temper due to sex differences. But there was significant difference between male and female students on a world view perspective and a set of attitudes. Male students' thinking was on the higher side.

5. It was revealed that the students from the schools situated in urban areas has much higher level of scientific temper than the students from schools of rural areas. This is true on the all four dimensions of Scientific Temper Scale.
6. It was indicated that the students from private schools possess higher level of scientific temper than the students from Government Schools.
7. It was inferred that the 9th class students of Hindu possess higher level of scientific temper than the 9th class students of Muslim. But there is no significant difference in a world view perspective of 9th class Hindu and Muslim students.
8. It was observed that the 10th class students of Hindu has high level of scientific temper than the 10th class students of Muslim. But there was no difference in these two groups on dimension IV- A world View Perspective.
9. It was observed that the male students of Hindu has higher level of scientific temper than the male students of Muslim.
10. It was revealed that there is no significant difference in the level of scientific temper of female Hindu and Muslim students.
11. It was observed that there is no difference in the level of scientific temper of rural Hindu and Muslim students. But there was significant difference between rural Hindu and Muslim students on all the dimensions of Scientific Temper Scale.

12. It was revealed that the urban Hindu and Muslim students significantly differ in their level of scientific temper. The urban Hindu students possess higher scientific temper. It was also revealed that there was no significant difference between Hindu and Muslim urban students regarding aversion to superstitions.
13. It was indicated that there is no significant difference between Government school Hindu and Muslim students on level of scientific temper. However there is significant difference on dimension II- aversion to superstitions. The Government school hindu students possess more aversion to superstitions.
14. It was observed that private school Muslim students possess more scientific temper than Private schools Hindu students. But there was no difference between two groups on a world view perspective of scientific temper.
15. It was revealed that 9th class and 10th class, Hindu and Muslim students significantly differ independently in their level of Scientific Temper. 10th class Hindu and Muslim students possess higher scientific temper than their 9th class counterparts.
16. It was indicated that there is no difference in the level of scientific temper due to sex difference. Hindu male and female students as well as Muslim male and female students possess same level of scientific temper independently.

17. It was revealed that rural and urban Hindu students are significantly differ on their level of scientific temper. Urban Hindu students possess higher scientific temper. Similarly rural and urban Muslim students differ on their level of scientific temper.
18. It was indicated that Hindu students from Government and Private schools differ in their scientific temper Hindu students from Private school possess higher scientific temper. Similarly Muslim students from Government and Private schools differ in their level of scientific temper. Private school Muslim students possess higher level of scientific temper.

7.10 Findings Related to Relationship Between Understanding of Science and Scientific Temper

1. There is significant relationship between understanding of science and scientific temper. It was revealed that scientific temper has significant correlation with concepts of science, science policy perspective and science value perspectives. Similarly, there was significant relationship between dimensions of scientific temper and understanding of science.
2. This study has reveavled that the total sample of Hindu students have significant relationship between understanding of science and scientific temper. It is true in the case of Muslim students too.

3. This study has revealed that the total sample of 9th class and 10th class students has significant correlation between understanding of science and scientific temper.
4. There has been no effect of sex on relationship between understanding of science and scientific temper. The relationship between the two was significant.
5. There has been no effect of students of schools situated in urban and rural geographical locales on the relationship between understanding of science and scientific temper.
6. It was revealed that there has been no effect on students from Private and Geovernment schools on the relationship between understanding of science and scientific temper.

7.11 Educational Implications

India has accepted planned national development, and, in the order of priorities, education has been accorded a high priority as an integral part of country's national developmental process. Consequently, the number of literates has increased tremendously, enrolment at the primary school level has been encouraging, the infra structure for schooling has been provided to a great extent and trained teachers have been hired to implement the national education policy. Since education is a dynamic, continuous process, it needs further efforts to provide relevance and quality. In particular, efforts would be made to raise the standards of science and mathematics.

India has started Science for All and all students study science compulsorily upto secondary level. At the primary level students learn science as environmental study, which provides relevance to science education. Yet much remains to be done. Aruna Narlikar (1989) has reviewed a film Global Warming and focused on the allied causes of environmental degradation. Environmental challenges such as acid rain, depleted ozone layer, deforestation and global warming are theatening the very survival of the human race.

Therefore, an awareness about these environmental hazards has become essential for public.

Secondly, India has been conventional societies which faithfully believe in old beliefs and miracles happening in the community. A genuine faith in conventional beliefs and in mircles means living on hope for all the time. The drinking of milk by the Ganesh idols in India, Nepal, Dhaka, London, U. S. A. and other places on September 21, 1995 has presented a picture of miracle-promoting credulity and straining credibility. This miracle was taken as a miracle, strengthening the conventional faith of supernatural powers in people and taking scientists' explanation phony. The rationlist who refuses to accept miracles, was reduced to minority.

These two pointers - science related environmental issues and faith in traditional beliefs necessitates scientifically literate citizens, who understand science and use scientific temper for quality living. It has far reaching educational implications.

This investigation leads further about the problems of population control, controlling industrial disasters and diseases such as plague and malaria. Hopefully, scientific knowledge will provide sound base for developing scientific thinking and values of science. An educational programme demands changes in (i) Goals of Science education, (ii) Science curriculum, (iii) Teaching-learning interaction processes and (iv) Assessment of formal and non-formal science education programmes.

It leads to rethinking about the contemporary challenges of life and living, as evidenced by our ecological, health and energy problems.

Goals of science education should lead to understanding of science and development of scientific temper. The goals of science education given by Hodson and Reid (1988) are appropriate and useful in developing a brief list :

* General awareness of science concepts.
* Application of science problem solving skills to everyday situation.
* Independence of thought and self-confidence.
* Perseverance and tenacity in the face of difficulties.
* Intellectual curiosity.
* Tolerance of the views of others.
* Willingness to predict, speculate, and take 'intellectual risks'.
* Openmindedness.

* Self criticism.
* Honesty and integrity in carrying out and reporting, experimental work.
* Informed and healthy scepticism based on the limitations of science.
* Suspended Judgement.
* Recognising the role of science in shaping society.

Science Curriculum

A common science curriculum needs appropriate content which is relevant, adequate, accurate and contemporary. It should be related to real life situations. It should be philosophically and psychologically sound (Hodson, 1985). Such a coherent scientific curriculum should contain following (Reid, Hodson, 1985) :

1. Science knowledge - facts, concepts, theories.
2. Application of Knowledge.
3. Skills and processes of science.
4. Problem solving and interaction with technology.
5. Economic, ethical, social and political issues in science.
6. Philosophical and sociological considerations.

Teaching Learning Interactions and Assessment :

The new curriculum have enormous implications for teaching and learning methods and assessment procedures and science teachers' attitude. learning should be learner centered and a variety of learning

routes should be explored to meet the needs of different abilities of students. The notion of mastery learning carries with it a clear specification of minimum levels of expected attainment and criterion referenced assessment. It needs a well designed assessment and evaluation strategy, capable of continuously monitoring the progress of each individual.

7.12 Future Research Perspectives

This area is full of rich and varied future research. India is full of diversities both in educational and social context which forms the base of research. This area is directly related to philosophical and sociological science education aspects. Some of topics for future research may be as follows :

1. A study of the impact of Non formal sources of learning science on understanding of science and scientific temper.
2. A study of the Public Understanding of Science in different geographical locales.
3. A study of mass media impact on the Public understanding of science.
4. A study of science concepts, such as, energy, environment and genetic engineering.
5. A study of students ideas on nutrition.
6. Scientific literacy and non-formal sources of learning : A Comparative Study.

7. A study of science for the masses : Goals and Achievements.
8. A study of Scientific temper among Science teachers.
9. A study of Environmental Awareness among different groups of People.
10. A study of science concepts and Values among different groups of people.
11. A study of the classroom discussion of Social Issues.
12. A study of Science concepts, such as, Kidney Transplant, Industrial Waste and Nuclear Power.
13. A study of the awareness of science among general public.
14. A study of methods strategy and programmes for inculcating Understanding of Science and Scientific Temper among different groups of peoples and students.

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APPENDICES

Appendix A

THE UNDERSTANDING OF SCIENCE SCALE

(विज्ञान अवबोधन मापन)

By :
Leela Pradhan (Kansakar)

DIRECTIONS :

The following statements are related to the Understanding of Science. Read each statement carefully and then mark your answer on the answer sheet provided. Record your first impression and feeling that comes to your mind, as you read the item.

निर्देश :

निम्नलिखित कथन विज्ञान के अवबोधन से संबंधित हैं। प्रत्येक कथन को सावधानी पूर्वक पढ़ें और दिए गए उत्तर पत्र पर अपने उत्तर अंकित करें। तत्परता से काम करें। जब आप कथन को पढ़े तब आपके मस्तिष्क में जो विचार पहले आये उसे ही चिन्हित करें।

It is a three point scale showing your position to agree, neutral and disagree to an item.

यह तीन बिन्दु परक मापन है जो किसी कथन पर आपके सहमत, उदासीन और असहमत को दर्शाता है।

Draw a circle around (A) if you agree with the item.

यदि आप कथन से सहमत हैं तो ए के चारों ओर एक वृत्त खींचे।

Draw a circle around (N) if you are neutral.

यदि आप उसके प्रति उदासीन हैं तो एन के चारों ओर वृत्त खींचे।

Draw a circle around (D) if you disagree.

यदि आप कथन से असहमत हैं तो डी के चारों ओर वृत्त खींचे।

Example : Tajmahal is a beautiful building. (A) N D

उदाहरण – ताजमहल एक सुन्दर इमारत है। ए एन डी

Since A is circled it means that you agree with the statement.

चूंकि ए के चारों ओर वृत्त खींचा हुआ है तो इसका अर्थ है कि आप इस कथन से सहमत हैं।

Answer all the statements. You will have 40 minutes which should give sufficient time to complete all 40 items.

सभी कथनों का उत्तर दीजिये। आपके पास 40 मिनट हैं जो सभी 40 कथनों के लिए पर्याप्त समय है।

Please donot mark on the test booklet.

कृपया इस प्रश्नावली पर किसी प्रकार का चिन्ह न लगायें।

1. Use of insecticide is harmful to health.
1. कीटनाशक औषधि का उपयोग स्वास्थ्य के लिए हानिकारक है।

2. Use of solar energy can solve fuel problems.
2. सौर्य ऊर्जा के उपयोग से ईंधन की समस्या हल हो सकती है।

3. Methyl isocyanide (MIC) is not a killerr toxic gas.
3. मीथाइल आइसोसाइनाइड (एम. आई. सी.) एक विषाक्त गैस नहीं है।

4. Explosion of Chernobyl did not produce radioactive substances killing people.
4. चर्नोबाइल विस्फोट से मनुष्य के लिए घातक रेडियो एक्टिव पदार्थ उत्पन्न नहीं हुए हैं।

5. Mosquitoes are the carriers of AID virus.
5. मच्छर एडस वाइरस के वाहक हैं।

6. Industrial wastes are not poisoning river water.
6. औद्योगिक अवशिष्ट से नदियों का पानी विषाक्त नहीं हो रहा है।

7. Production of nuclear energy is fully safe.
7. नाभकीय ऊर्जा का उत्पादन पूर्ण रूप से सुरक्षित है।

8. Organ transplant is in-human.
8. अंगों का प्रत्यारोपण अमानवीय है।

9. Nutritional food is essential for health.
9. पौष्टिक आहार स्वस्थ जीवन के लिए आवश्यक है।

10. Use of tobacco is injurious to health.
10. तम्बाखु का उपयोग स्वास्थ्य के लिए हानिकारक है।

11. Software is a term used in computers.
11. 'साफ्टवेयर' कंप्यूटर शब्दावली में प्रयोग में आता है।

12. Genetic engineering Research should not be promoted.
12. जीन प्रौद्योगिकी अनुसंधानों को प्रोत्साहन नहीं देना चाहिए।

13. Computer virus is dreaded disease.
13. कंप्यूटर वाइरस भयानक रोग है।

14. Biotechnology is a field to solve many socio scientific problems.
14. जीव प्रौद्योगिकी कई समाज एवं विज्ञान की समस्याओं को हल करने का क्षेत्र है।

15. Cell is a structural and functional unit of life.

15. कोशिका सजीवों की संरचनात्मक एवं क्रियात्मक ईकाई है।

16. Depletion of ozone layer will not create any environmental disaster.

16. ओजोन सतह की कमी से कोई भी पर्यावरण नुकसान उत्पन्न नहीं होगा।

17. Production of nuclear energy is the means to meet global energy needs.

17. नाभकीय ऊर्जा उत्पादन ऊर्जा की सार्वभौमिक आवश्यकता की पूर्ति का माध्यम है।

18. Bioenergy is a source of fuel and manures.

18. जैव ऊर्जा ईधन एवं खाद का स्रोत है।

19. Biodiversity does not help in balancing man and environment.

19. जैव विभिन्नता मानव व वातावरण के संतुलन में सहायक नहीं है।

20. Now-a-days blood transfusion is safe.

20. वर्तमान में रूधिर स्थानान्तरण पूर्ण सुरक्षित है।

21. Population growth must be curbed to avoid depletion of scarce resources.

21. सीमित स्रोतों की कमी को दूर करने के लिए जनसंख्या वृद्धि का नियंत्रण आवश्यक है।

22. Public should be literate on population issues.

22. जनसंख्या समस्याओं पर जनता को साक्षर करना चाहिए।

23. Mass media has no effect in educating masses on population issues.

23. जनसंचार माध्यम का जनसंख्या शिक्षा पर कोई प्रभाव नहीं है।

24. A nation that destroys its soils, destroys itself.

24. एक राष्ट्र जो अपनी मिट्टी (मृदा) को नष्ट करता है स्वयं नष्ट होता है।

25. Destruction of forests does not increase imbalances between man and environment.

25. वनों के नष्ट होने से मानव व वातावरण असंतुलन वृद्धि नहीं करेगा।

26. Environmental destruction is related to application of Science and technology.

26. पर्यावरण विनाश का सम्बंध विज्ञान एवं तकनीकी के प्रयोग से है।

Appendix B

SCIENTIFIC TEMPER SCALE

(विज्ञान मनोवृत्ति मापन)

By :
Leela Pradhan (Kansakar)

DIRECTIONS :

The following statements are related to the Scientific Temper. The investigator has taken four dimensions of Scientific Temper, namely, Value Perspective, Aversion to Superstitions, A Set of Attitudes towards Science and World View Perspective. Read each statement carefully and then mark your answer on the answer sheet provided. Work rapidly. Record your first impression and feeling that comes to your mind, as you read the item.

It is a three point scale showing your position to agree, neutral and disagree to an item.

Draw a circle around (A) if you agree with the item.

Draw a circle around (N) if you are neutral.

Draw a circle around (D) if you disagree with the item.

Example :

Tajmahal is a beautiful building. (A) N D

Since A is circled it means that you agree with the statement.

Answer all the statements. You will have 30 minutes which should give sufficient time to complete all 30 items.

Please do not mark on the test booklet.

निर्देश :

निम्नलिखित कथन वैज्ञानिक मनोवृत्ति के प्रति आपके विचारों से संबंधित है। वैज्ञानिक मनोवृत्ति को चार पक्षों में लिया गया है। मूल्य परिप्रेक्ष्य, अंधविश्वास निवारण, विज्ञान के प्रति अभिवृत्ति एवं संसारिक अवलोकन परिप्रेक्ष्य। प्रत्येक कथन को सावधानीपूर्वक पढ़े और दिए गए उत्तर पत्र पर अपने उत्तर अंकित करें। तत्परता से काम कीजिए। जब आप कथन को पढ़े उस समय आपके मस्तिष्क में जो विचार पहले आये उसी को चिन्हित करें।

यह तीन बिन्दु परक मापन है जो किसी कथन पर आपके सहमत, उदासीन और असहमत को दर्शाता है।

यदि आप कथन से सहमत हैं तो ए के चारों ओर एक वृत्त खींचे।

यदि आप उसके प्रति उदासीन हैं तो एन के चारों ओर वृत्त खींचे।

यदि आप कथन से असहमत हैं तो डी के चारों ओर वृत्त खींचे।

उदाहरण – ताजमहल एक सुन्दर इमारत है। ए एन डी

चूंकि ए के चारों ओर वृत्त खींचा हुआ है तो इसका अर्थ है कि आप इस कथन से सहमत हैं।

सभी कथनों का उत्तर दीजिये। आपके पास 30 मिनट हैं जो सभी तीस कथनों के लिए काफी है।

कृपया इस प्रश्नावली पर किसी प्रकार का कोई चिन्ह न लगायें।

1. I believe in proved facts.
2. I take interest in investigation of new ideas.
3. Repeated observations help in drawing inferences.
4. My decisions are influeneed by the opinion of others.
5. My ideas are based upon scientific facts.
6. I believe in intelligent decisions based upon findings.
7. Knowledge gets destroyed by discussion.
8. Old facts change in the light of new scientific findings.
9. Beliefs given by parents should be accepted.
10. Logical opinions are worth accepting.
11. Failure in examination is due to bad luck.
12. Scientists desire to complete the gaps found in earlier explanations.
13. Scientists should be curious to know about the abnormal birth.
14. Once a law in Science is discovered it should be accepted.
15. After observing magic, a person should find out the secret of it.
16. Known natural phenomenon should not be investigated again.
17. General beliefs should not be preferred to scientific explanation.

1. मैं प्रमाणित तथ्यों में विश्वास करता हूँ।
2. मैं नवीन विचारों की खोज में रूचि रखता हूँ।
3. अवलोकन की पुनरावृत्ति निष्कर्ष निकालने में सहायक होती है।
4. मेरे निर्णय दूसरों के विचारों से प्रभावित होते हैं।
5. मेरे विचार वैज्ञानिक तथ्यों पर आधारित होते हैं।
6. मैं खोज आधारित मेधावी निर्णय पर विश्वास रखता हूँ।
7. चर्चा करने से ज्ञान नष्ट होता है।
8. पुराने तथ्य नवीन वैज्ञानिक उपलब्धियों से परिवर्तित होते हैं।
9. माता–पिता द्वारा दी गई मान्यताएं स्वीकारनी चाहिए।
10. तार्किक विचार स्वीकारने योग्य होते हैं।
11. परीक्षा में अनुतीर्ण होने का कारण दुर्भाग्य है।
12. वैज्ञानिक पूर्व स्पष्टीकरणों में विद्यमान अंतर को पूरा करने के इच्छुक होते हैं।
13. वैज्ञानिक असामान्य बालक के जन्म के प्रति जिज्ञासु होने चाहिए।
14. विज्ञान में एक बार खोजे नियम सदैव स्वीकारना चाहिए।
15. जादू देखने के पश्चात् व्यक्ति को उसके रहस्य को जानने को इच्छुक होना चाहिए।
16. ज्ञात प्राकृतिक नियमों की पुनः खोज आवश्यक नहीं है।
17. सामान्य मान्यताओं को वैज्ञानिक स्पष्टीकरण की तुलना में वरीयता नहीं देनी चाहिए।

18. I do not start work without asking parents.
19. Plague and other diseases are the product of divine anger.
20. I consult astrologers to predict weather.
21. Predictions by computers are always true.
22. Falling of astroids in sky is a sign of bad luck.
23. Use of science and technology have polluted biological environment.
24. Human and environment problems can be solved by scientists.
25. Accepting the use of scientific ideas have resulted green revolution in India.
26. Scientific research should not be encouraged.
27. Contributions of Science and medicine have reduced child birth rate.
28. Skilled manpower needs knowledge of Science and technology.
29. Science cannot give clean and healthy global environment.
30. In developing countries use of computer does not serve significant purpose.

18. मैं माता पिता की आज्ञा के बिना कोई कार्य प्रारंभ नहीं करता हूँ।
19. प्लेग एवं अन्य रोग दैविक प्रकोप से होते हैं।
20. मौसम की भविष्यवाणी के लिए मैं ज्योतिषों से परामर्श करता हूँ।
21. कम्प्यूटर द्वारा भविष्य कथन सदैव सत्य होता है।
22. आसमान से टूटने वाले तारे दुर्भाग्य के संकेत होते हैं।
23. विज्ञान और तकनीकी के प्रयोग से जैविक वातावरण प्रदूषित हुआ हैं।
24. मानव एवं वातावरण समस्यायें वैज्ञानिकों द्वारा हल की जा सकती हैं।
25. भारतवर्ष में हरित क्रांति वैज्ञानिक विचारों के अपनाने से संभव हुई है।
26. वैज्ञानिक अनुसंधान को प्रोत्साहित नहीं करना चाहिए।
27. विज्ञान एवं चिकित्सा शास्त्र के योगदान से जन्मदर कम हुई है।
28. कुशल मानव शक्ति को विज्ञान और तकनीकी के ज्ञान की आवश्यकता है।
29. विज्ञान स्वच्छ और स्वस्थ सार्वभौमिक वातावरण प्रदान नहीं कर सकता।
30. विकासशील देशों में कम्प्यूटर का उपयोग किसी महत्वपूर्ण उद्देश्य का नहीं है।

Appendix C

Science Writers' Calendar*

January	
First Week	National Road Safety Week
	Indian science Congress
30	Anti-Leprosy Day in India
February	
28	National Science Day
March	
8	International Women's Day
16	Measles Vaccination Day
22	World Water Day
23	World Meteorological Day
24	World Tuberculosis Day
April	
7	World Health Day
22	Earth Day
23	World Book & Copyright Day
26	World Intellectual Property Day
May	
1-7	Malaria Prevention Week
11	National Technology Day
17	World Telecommunication Day
31	World No-Tobaco Day
June	
5	World Environment Day
26	International Day against Drug Abuse & Illicit Trafficking
July	
11	World Population Day
August	
1-7	World Breast Feeding Week
9	International Youth Day
25-Sept. 8	National Eye-Donation Fortnight
September	
1-7	National Nutrition Week
8	International Literacy Day Eye Donation Day
16	World Ozone Day
October	
1	International Day for the Elderly
	Voluntary Blood Donation Day
1-7	Wild Life Week
1st Mon.	World Habitat Day
	Universal Children's Day
2nd Wed.	International Day for Natural Disaster Reduction
9	World Post Day
16	World Food Day
21	Global Iodine Deficiency Disorders Day
24	United Nations Day
	World Development Information Day
November	
7	National Cancer Awareness Day
19-Dec.18	National Evironment Month/ National Environment Awareness compaign
December	
1	World AIDS Day
2	National Pollution Prevention Day
14	National Enrgy Conservation Day
29	International Day for Biological Divensity
Last Week	National Children Science Congress

* Source : *Everyman's Science* Vol. XL No. 5, December 2005-January 2006, p. 370

Appendix D

Awards and Prizes*

Name of Prize	Year Installed	Value	Organisation	Period
Kalinga Prize	1951	Pound 2000	UNESCO Paris (France)	Annual
Indira Gandhi Prize for Popularisation of Science	1986	Rs. 10,000/-	Indian National Science Academy New Delhi	Biennial
National Award for :	1987		Union Ministry of S & T	Annual
i) Science Popularisation		Rs. 2,00000/-		
ii) Best S & T coverage		Rs. 1,00000/-		
iii) Science Popularisation among children		Rs. 1,00000/-		
iv) Science Translation in Indian Languages		Rs. 1,00000/-		
Chemical Award for Science Writing on Indian Themes	1994	Rs. 10,000/-		Annual
Dr. B. C. Deb Memorial Award for Popularisation of Science	1994-95	Rs. 5,000/-	Indian Science Congress Association, Kolkata	Annual
C. B. Sharma Memorial Award of Science Popularisation	1995		Indian Science Writers Association, Delhi	Annual

* Source : *Everyman's Science* Vol. XL No. 5, December 2005-January 2006, p. 372

Appendix E

25 Years of NCSM
Important Achievements at a Glance*

Year of Inauguration	Science Centres & Planetariums
1978	Shrikrishna Science Centre, Patna
1982	District Science Centre, Purulia
1984	District Science Centre, Gulbarga
	District Science Centre, Dharampur
1985	Nehru Science Centre, Mumbai
1987	District Science Centre, Tirunelveli
1989	Regional Science Centre, Lucknow
	Regional Science Centre, Bhubaneswar
1992	National Science Centre, Delhi
	Raman Science Centre, Nagpur
1993	Central Research & Training Laboratory, Kolkata
	Bardhaman Science Centre, Tirupati
1994	Bardhaman Science Centre Regional Science Centre, Guwahati
1995	Regional Science Centre, Bhopal
	Dhenkanal Science Centre Kapilas
	Science Park Science Activity Corner, Gwalior
1997	Raman Planetarium, Nagpur
	Regional Science Centre, Calicut
	Calicut Planetarium
	Science City, Kolkata
	North Bengal Science Centre, Siliguri
	Digha Science Centre
2001	Kurukshetra Panorama & Science Centre, Kurukshetra
	Goa Science Centre
2003	Science Centre, Port Blair
	Mizoram Science Centre

* Source : *Everyman's Science* Vol. XL No. 5, December 2005-January 2006, p. 375

Appendix F

Some Important Websites for Science Writers

AlphaGalieleo-The world's leading resource for European research news *(www.alphagalileo.org)*-AlphaGalileo is the fast effective way to get news to journalists around the world.

Eurek Aletrt-*(www.EurekAlert.org)*-EurekAlert is an online, global news service operated by AAAS

National Council for Science & Technology Communication. Department of Science & Technology. *(www.vichar.nic.in)*-NCSTC has played a pioneering role in science popularization in India.

Vigyan Prasar Science Portal-*(www.vigyanprasar.com)*-for anything and everything on science from India.

Scientoons-A novel tool in science communication-*(www.scientoon.com)*-Scientooning as a new branch of science that deals with effective science communication by using a novel class of science cartoons called scientoons.

Indian Science writers Association-*(www.iswaindia.com)*

National Institute of Science Communication And Information Resources *(www.nicair.res.in)*

SciDevNet (Science and Development Network)-*(www.SciDev.Net)* New, views and information about science, technology and the developing world.

United Nations Educational, Scientific and Cultual Organization (UNESCO)-*(www.unesco.org)*

Indian Council of Medical Research (ICMR)-*(www.icmr.nic.in)*

India Image-*(www.nic.in)*-A gateway to Goverment of India Information over the web *www.encyclopaediabritanica.com*

MSN Encarta-*(www.encarta.com)*-Online search for Encyclopedia, Dictionary, Atlas, Photos, Magazines and Homework Plane etc. *(www.nesm.org)*

Press Trust of India *(www.ptinews.com)*

Press Information Bureau *(www.pib.nic.in)*

United News of India *(www.uniindia.com)*

Google *(www.google.com)* : One of the widely use search engines

Google Scholar *(http://scholar.google.com)*

Scirus *(www.scirus.com/srsapp)* : for scientific information only

Internet Information Centre *(http://nnlm.gov/netinfo)*

Medical search engines and meta-sites *(http://library.uchc.edu/eduoff/medsites.html) www.doaj.org*

Free Medical Journals *(www.freemedicalijournals.com)*

PubMed *(www.ncbinlm.nih.gov/entrez/guery.fegi)* : The US National Library of Medicine's search service that provides a free searchable access to over 11 million citations and abstracts in MEDLINE and other related databases, with links to participating online journals.

PunMed Central *(http://pubmedcentral.nih.goy)* : The US NLM's digital archive of life sciences journal literature.
Access to PMC is free and unrestricted

BioMed Central *(www.biomedcentral.com)* : A commercial publisher which provides immediates free access to peerreviewed biomedical research.

IndMEd *(http://indmed.nic.in)* : ICMR-NIC Centre for Biomedical Information, New Delhi Provides, among others, a bibliographic database of 75 peer-reviewed Indian Biomedical Journals.

Amediao *(www.amedeo.com)* : The medical literature guide.

International Committee of Medical Journal Editors (ICMJE) *(www.icmje.org)* : A group of medical journal editors met informally in Vancouver.

World Association of Medical Editiors *(www.wame.org)*

Council of Science Editors (CSE) *(www.councilscieneeditors.org)* : CSE is a leader in promoting ehtical practices in science publishing.
European Association of Science Editors (EASE) *(www.ease.org.uk)*

Bioline International *(http://bioline.bdt.org.br)* : A non-profit electronic publishing service committed to providing access to quality research journals published in developing countries. www.healthinternetwork.org.